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MISCELLANEOUS NEW ASCLEPIADACEAE FROM TROPICAL AMERICA

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CYNANCHUM (METALEPIS) **Marsdenioides** Woodson, spec. nov. Frutex volubilis lactescens usque 5 m. vel ultra attingens; ramulis crassiusculis juventate minute puberulis mox glabratis post exsiccationem conspicue striatis pallidis. Folia opposita longe petiolata late ovato-elliptica basi late cordata apice abrupte longiuscule acute acuminata 14–16 cm. longa 9–10 cm. lata firme membranacea glabra nervo medio supra basi conspicue pectinatim pluriglanduloso, petiolis 7–8 cm. longis. Inflorescentiae (ramuli florigerentes aphylli) axillares oppositae, pedunculo 15–26 cm. longo crassiusculo minute puberulo-striato, internodiis basi 6–8 cm. longis apicem versus gradatim brevioribus, ramulis bostrycino-racemosis plurifloris unilateraliter 2–3-natim positis inaequilongis 2–6 cm. longis aliquando more pedunculi primarii compositis, pedicellis 0.4 cm. longis minute puberulis. Calycis lobi oblongo-lanceolati ca. 0.35 cm. longi glabri. Corolla ut videtur gilva vel viridula rotata, lobis ovatis acuminatis ca. 0.2 cm. longis 0.15 cm. latis basi concavis extus glabris intus apicem versus pilosis. Corona plane cyathiformis ca. 0.2 cm. diam., lobis 5 quadratis intus minutissime papillatis marginibus anguste involutis. Gynostegium breviter (ca. 0.05 cm.) stipitatum disciforme ca. 0.2 cm. diam., stigmate umbonato; polliniis pendulis anguste reniformibus ca. 0.05 cm. longis, caudiculis subhorizontalibus ca. 0.1 cm. longis, corpusculo mediocri. Folliculi ut dicitur fusiformi 22–25 cm. longi ca. 10 cm. crassi.—ECUADOR: LOS RIOS: Oct., 1934, *Y. Mexia 6660*, whence grown from seed at Puerto Rico Experiment Sta. U. S. D. A., Mayaguez, P. R., *R. H. Moore 2163* (U. S. Nat. Arb. Herb., TYPE).

Most closely related to *C. Haughtii*, also of Ecuador, but with very precise distinctions: *C. Haughtii* has more deeply concave corolla-lobes; the corona segments are sharply inflexed, are conduplicate-emarginate, and are separated by smaller, alternate lobules; the sepals are proportionately broader and pilosulose

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without; the caudicles of the pollinia are somewhat shorter and are concealed by the anther appendages whilst they are conspicuous in *C. Marsdenioides* as in *C. cubense*.

It may be worth while at this juncture to comment upon the compound "inflorescence" of the various species of *Cynanchum* subgen. *Metalepis* which differ superficially from the inflorescence of most other Asclepiadaceae in their truly axillary position. As is well known, the true inflorescence of Asclepiadaceae generally is extra-axillary and interpetiolar. An examination of any of the five published species of *Cynanchum* subgen. *Metalepis* demonstrates that the inflorescences, all compound and axillary, are homologous with the vegetative branches, since the flowering secondary peduncles are borne in an extra-axillary or "interpetiolar" position with respect to the bracts (*i. e.* reduced foliage leaves).

Cynanchum (Metalepis) **peraffine** Woodson, spec. nov. Frutex volubilis lacteus; ramulis gracillimis glabris, internodiis elongatis. Folia opposita late ovata apice abrupte subcaudato-acuminata basi rotundate cordata 5–9 cm. longa 3–6 cm. lata tenuiter membranacea utrinque glabra nervo medio supra basi glanduligera; petiolis tenuibus 2.5–4.0 cm. longis glabris. Inflorescentia axillaris longiuscule pedunculata congeste bostrycino-racemosa pluriflora, pedunculo 2.5–4.0 cm. longo apicem versus florigero ibique puberulo basim glabro, pedicellis 0.2–0.3 cm. longis puberulis. Calycis lobi ovato-lanceolati acuminati extus minutissime sparseque pilosuli. Corolla alba, tubo cylindrico ca. 0.15 cm. longo ca. 0.2 cm. diam. extus glabro, lobis ovato-lanceolatis acutis 0.5 cm. longis patulis margine revolutis extus glabris intus margine dense puberulo-papillatis. Corona cyathiformis, lobis 5 acute emarginatis ca. 0.05 cm. longis minute papillatis compositis. Gynostegii stipes conicus ca. 0.08 cm. altus dense papillatus; stigmate umbonato cum antheris ca. 0.3 cm. diam.; polliniis pendulis anguste reniformibus ca. 0.08 cm. longis, caudiculis ca. 0.1 cm. longis, corpusculo mediocri. Fructus ignoti.—Mexico: oaxaca: in llanos, Distr. Tuxtepec, Chiltepec and vicinity, alt. about 20 m., July, 1940 - Feb., 1941, *G. Martínez-Calderón 258* (U. S. Nat. Herb., no. 1,808,120, type).

Very closely related to *C. cubense* (Griseb.) Woods., which has mucronate or more gradually acute leaves, apparently of heavier texture, and somewhat smaller flowers with campanulate corolla tubes and nearly quadrate corona lobes. The two species present an interesting case of geographic parallelism.

Matelea (Eumatelea § reticulatae) **serpens** Woodson, spec. nov. Fruticulus volubilis prostratus; ramulis tenuibus longiuscule pilosis, internodiis sat elongatis. Folia opposita ovato-lanceolata apice longe acuminata basi late cordata 3–5 cm. longa 1.5–2.5 cm. lata membranacea utrinque plus minusve pilosa nervo medio supra basi inconspicue glanduligera, petiolis tenuibus 1.5–2.0 cm. longis longiuscule pilosis. Inflorescentia extra-axillaris longe pedunculata umbelliformis pluriflora, pedunculo 2–4 cm. longo tenui laxe piloso, pedicellis tenuibus in flore ca. 1 cm. longis post anthesem conspicue elongatis, bracteis conspicuis foliaceis linearibus longe acuminatis 0.4–0.8 cm. longis. Calycis lobi ovato- vel oblongo-

elliptici acuti in flore 0.6 cm. longi post anthesem ad 1 cm. accrescentes conspicue foliacei extus longiuscule pilosi glandulis minutis sessilibus brunneis interspersis. Corolla rotata ca. 1.3 cm. diam. ut videtur gilva; lobis ovato-ellipticis acutis ca. 0.5 cm. longis extus medio pilosis intus glabris. Corona vix manifesta, limbus inconspicuissimus gynostegio basi solum annectus. Gynostegii stipes ca. 0.1 cm. longus 0.15 cm. crassus; stigmate late conico ca. 0.2 cm. diam. 0.1 cm. alto luteo; antheris sub stigmate positis; polliniis horizontalibus obpyriformi-subcoclearibus profunde excavatis cum caudiculis alatis ca. 0.08 cm. longis, corpusculo minuto. Folliculi ignoti.—MEXICO: NUEVO LEON: on Pan American Highway, near Monterrey, Apr. 26, 1939, *T. C. & E. M. Frye 2490* (U. S. Nat. Herb., no. 1,809,052, TYPE).

This species differs from all Mateleas with which I am acquainted because of its white or cream-colored corollas and conspicuous, foliaceous calyx lobes. The extreme reduction of the corona also is noteworthy.

NOTES ON VARIATION IN TITHONIA TUBAEFORMIS

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The following notes on variation in *Tithonia tubaeformis* (Jacq.) Cass. were made in S. P. Tlaquepaque, Jalisco, Mexico, where that species grows abundantly along roadways and along the edges of cultivated fields. They were made to supplement the herbarium specimens taken at the same time which have been deposited in the herbarium of the Missouri Botanical Garden.

There is a good deal of variation in form and color from plant to plant as well as on different parts of the same plant. The most conspicuous is in the color of the disk flowers. One form, the commoner, has orange-red on the outside of the disk corollas and on the tips of the chaff of the receptacle. The corolla of the other is dark red, and the difference between the two forms is independent of the age and development of the flower head and is not correlated with the color of the stamens. This same discontinuous variation was noted in other parts of Jalisco.

There is much variation also in the size and shape of the rays and of the involucral bracts. Twenty well-developed plants were examined, and a head terminal to a secondary branch was chosen from each. Heads with about half the disk in flower were selected, eliminating a good deal of the variation caused by different stages of development. Color of disk flowers, number of rays, and length and width of an average ray were recorded for each head. The results are shown in fig. 1. The rays vary from 2¼ to 3½ times as long as broad. There is a tendency for many-rayed plants to have smaller rays and for few-rayed plants to have larger rays. In this sample the three plants with dark disks were among those with fewer, larger rays.

Though *Tithonia tubaeformis* is seldom actually planted as an ornamental, it is on the border-line between a cultivated plant and a weed. It comes up in fenced-in gardens and is so often allowed to develop that its orange-yellow flowers are the dominant color note of many little villages in October and November. The seeds apparently are not gathered but the whole plant is frequently cut for coarse hay used in packing, etc.

Figure 1 and the accompanying article are merely a demonstration of the way in which the essential facts regarding variation in a population can be compressed into one diagram which serves as an exact record of the essential facts and a tool in analysis. Selecting flower heads in the manner described removed much of the non-genetic variability. Plant-to-plant variation was then found to be largely concentrated in (1) ray size, (2) ray shape, (3) ray number, (4) corolla color. The inter-relations of all four of these variables are shown in fig. 1. The broken lines for length-breadth proportions have been drawn in as a visual aid in translating position on the chart into ray-shape.

Each circle represents the data from one head, selected one to a plant. Heavy-lined circles represent plants with dark red corollas, the others represent yellow corollas. The figures inside the circles are the number of ray flowers. The position of the circles with regard to the vertical and horizontal scales indicates ray length and breadth respectively.

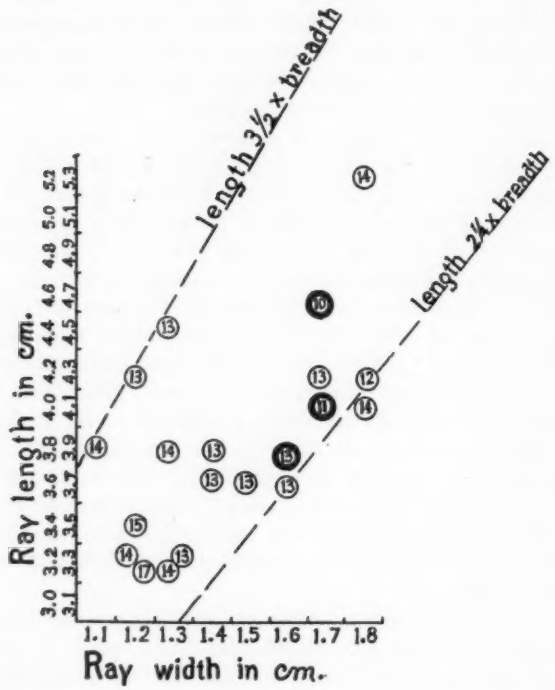

Fig. 1. Variation in ray number, ray length, ray width, and corolla color among 20 plants of *Tithonia tubaeformis* from one locality. Further explanation in the text.

A single chart of this sort is little more than an accurate record of 80 different facts (4 each for 20 plants) and their inter-relationships. A series of such charts for different populations of this species, or comparable charts for other species of *Tithonia*, would allow us to make a real study of evolution in this group of plants. While this method of recording variation was worked out for *Tithonia* it would certainly be quite as effective with the annual species of *Helianthus* and probably with a good many other composites.

A METHOD FOR RECORDING AND ANALYZING VARIATIONS OF INTERNODE PATTERN

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AND DOROTHY SCHREGARDUS

This paper is an attempt "to make measurable that which has not yet been measured," the general habit of a plant. Those systematists who are also good field naturalists are often intrigued by the fact that closely related species of plants are commonly recognizable, even at a distance, by their peculiarities of habit, which are often more reliable than any single characteristic. But habit is difficult to convey to others and difficult to phrase concisely for a key or a technical description. It is based upon a number of things: the size, shape, positions, and textures of the leaves and the internode patterns of the vegetative shoot and the inflorescence. This paper provides an objective means for the analysis of variation in the latter.

Closely related species of the higher plants frequently differ in their internode pattern. That is to say, they may differ from each other not only in the number of internodes and their absolute dimensions but in the relative sizes of successive internodes and *in the pattern of change of relative size.* Unfortunately, there is usually so much variation from plant to plant that examination alone will not suffice to reveal the more or less constant tendencies which are being obscured by individual variation. Differences in internode pattern are apparently brought about largely by growth-regulating influences (of which auxin is certainly only one of several) which proceed from the root, from the stem apex, from leaves, flowers and fruits. The distribution of these substances is under such an internally correlated control system that successive internodes frequently become increasingly smaller or larger in an exact fashion and the increase or decrease may be described in mathematical terms (Prat, '35).

Before internode patterns can be studied, either as an interesting phenomenon in their own right or as a tool in taxonomic, genetic, and physiological investigations, we need a technique for recording and analyzing them. A simple method is presented below which overcomes the inadequacy of the human eye in perceiving rates of change. In fig. 1, for example, there are diagrammed the internodes of four hypothetical stems, A, B, C, and D. Two of these have fundamentally different growth patterns, though that fact will be apparent to relatively few biologists when the data are presented in this fashion. Almost any observant person will immediately note the differences in absolute length and in number of internodes. Most biologists will see the various differences in proportion. Few or none will note the fundamental change in proportion. In all four stems the inter-

nodes are getting increasingly larger but in A and B the increment is itself increasing while in C and D it is decreasing. If, however, we measure the lengths of successive internodes and diagram them from a common base line as in fig. 2, and then connect these points with straight lines for the eye to follow, the change in rate of increase is immediately apparent. A and B produce a fundamentally different curve from C and D.

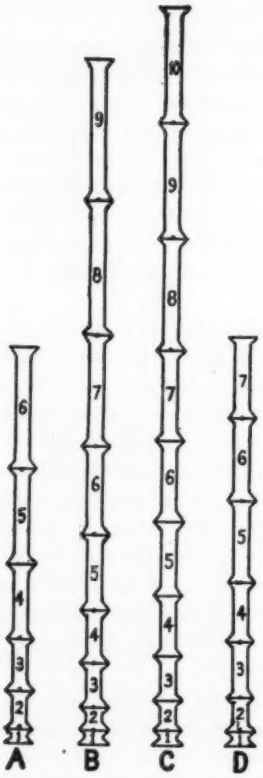

Fig. 1. Nodes and internodes of four hypothetical plants represented diagrammatically but to scale. The internode patterns of A and B are fundamentally different from those of C and D.

The use of logarithmic scales will immediately suggest itself to students of dynamic morphology. Prat ('35) has been successful with this method in analyzing the growth patterns of grass culms, and there are certainly many other kinds of material to which it might be applied. However, the internode patterns

of plants are so various and many of them may be of such complexity that some simple method such as that outlined above should be tried out in each case until the fundamental facts have been established.

The internode pattern differences of two species of *Tradescantia* are illustrated in fig. 3. The method of fig. 2 has been extended by using circles to represent inflorescences and broken lines to represent secondary branches of the main stem (for a more elaborate representation of branching see below). The diagrams were prepared from herbarium specimens, and the small internodes at the base of the stem were ignored, though their pattern is also significant. Figure 3 shows that

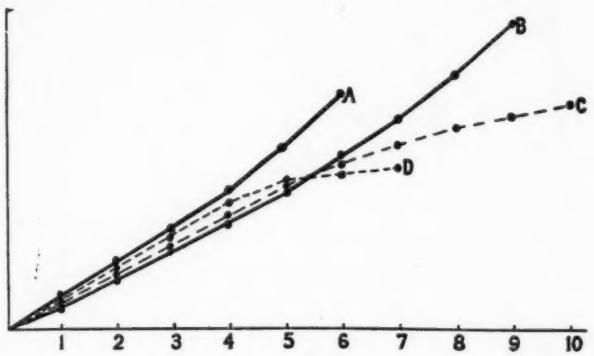

Fig. 2. The data of fig. 1 represented as internode diagrams. Vertical scale, length of internode; horizontal scale, successive internodes. The fundamental difference between A & B and C & D is immediately apparent.

the internode patterns of the two species present a number of out-and-out differences and an even larger number of tendencies to differ. The following are readily demonstrated:

1. *T. subaspera typica* has more internodes.

2. The longest internodes on *T. canaliculata* are usually longer than the longest on *T. subaspera typica*.

3. *T. subaspera typica* has 1 or 2 nodes of increasing magnitude at the base of the stem; *T. canaliculata* has 2 to 5.

4. The terminal internodes of *T. subaspera typica* decrease regularly in length. The decrease is so regular that the graph tends very strongly to be a straight line and might be described mathematically in exact terms. *T. canaliculata* has no such tendency; the terminal internodes may or may not be somewhat shorter than those preceding them.

The diagrams of fig. 3 illustrate several other significant points. *T. canaliculata* is a ubiquitous weed over a wide territory (Anderson and Woodson, '35). It in-

cludes a number of more or less differentiated races or sub-species which were once probably quite distinct but whose characters and distributions have been greatly modified by civilization (Anderson and Hubricht, '38). The three diagrams in the center of the figure represent one of these vaguely defined races in Texas and Oklahoma. *T. subaspera typica* and *T. canaliculata* sometimes hybridize when man so distorts the natural balance of things that hybrids can be produced and can find an intermediate habitat in which to survive (Anderson and Hubricht, '38,

Fig. 3. Internode diagrams of five plants of *Tradescantia canaliculata* (above) and *T. subaspera* var. *typica* (below). Circles represent inflorescences and dotted lines represent branches. Each division on the scale at the left equals two centimeters.

Hubricht and Anderson, '41). One of the plants of *T. subaspera typica* came from such a habitat and was collected only a few feet from an apparent F_1 hybrid between the two species. While in its other characters it shows little influence of *T. canaliculata,* its internode pattern is so different that several biologists who have been shown these diagrams have been able to pick out the plant immediately. It is the third from the left in fig. 3.

Internode diagrams are particularly useful in analyzing such natural populations in which hybridization has occurred but in which it is not evident whether it is a blind alley or whether the variability of one or the other of the parental species is being enriched by back-crossing. Even in those cases where the parental species

are so strikingly different that first-generation hybrids can be identified by inspection, it is a very difficult discipline so to train the eye that possible back-crosses can be distinguished. Unanalyzed variation in internode lengths gives the observer a vague impression as to the degree of variation but it usually does not answer the much more important question of its *direction*. Figure 4 illustrates a case in point, the hybridization between two species of Sage recently discussed by Epling ('44, pl. 4). Numerous individuals of both species and occasional undoubted

Fig. 4. Internode diagrams of two species of *Salvia* from Mt. Wilson, California, and a suspected back-cross hybrid. Same scale as fig. 3.

hybrids between them were studied along the Mt. Wilson road. At various points near well-established hybrids there were peculiar plants of *Salvia mellifera* but even Dr. Epling was unable to determine whether the variation was in the direction of S. *apiana*, as we would expect if the peculiarities were due to back-crossing.

Figure 4 suggests that the two species differ by the number of internodes below the flower, by the number of flowering nodes, and by whether the terminal internode is much longer than the one below it or of about the same size. It will be seen that in all of these characters the queer-looking individual departs from normal S. *mellifera* in the direction of S. *apiana*. The evidence from internode pattern would therefore suggest that it arose as a back-cross between S. *mellifera* and the first-generation hybrid which was growing near by. The internode diagrams (of which those in fig. 4 are a small sample) not only answered this question; they defined the internode differences between the two species so exactly that it was possible to study variation within and between these two species with a precision and an understanding hitherto impossible.

Sometimes the internode patterns of the secondary stems or of the inflorescences may be more significant than those of the main stem. They may then be diagrammed separately or combined in various ways. After a number of trials the technique shown in fig. 5 has apparently the widest applicability. It diagrams two plants each of two species of *Tripsacum*. The secondary branches are diagrammed

from a new base line immediately above the node at which they originate and the tertiary branches from a still higher base line. The tertiaries of *T. Lemmoni* were too short at the time the measurements were made to register on the scale and are therefore indicated as short vertical lines of the approximate number of internodes.

The method described above might prove useful in a number of ways. Its prime importance will be to the student who is trying to understand specific or racial differences as well as to describe them. A monographer working in the field

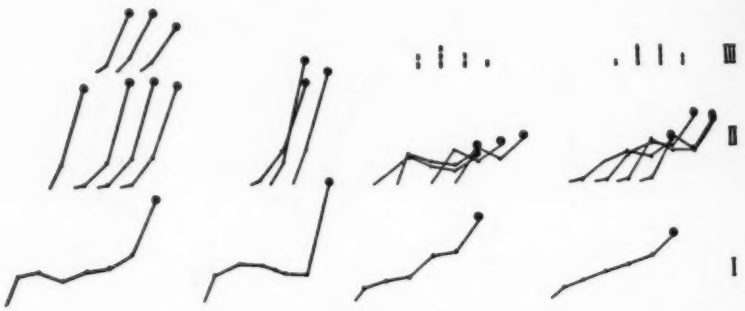

Fig. 5. Internode diagrams of two plants of *Tripsacum dactyloides* (left) and two of *T. Lemmoni* (right). Scale and construction as in figs. 3 and 4. The main axes of the four plants are diagrammed on line I, the secondary branches on line II and the tertiary branches (when present) on line III. The dotted lines for the tertiaries of *T. Lemmoni* represent short sterile branches of one to three nodes too short to be shown on the same scale as the rest of the diagrams.

of pure taxonomy would probably have little to learn from this method. Only in exceptional instances will it reveal a clear-cut specific difference which can be neatly phrased in a few words and incorporated in the description of a species or used in a key. However, the student of the species problem will find such characters as internode pattern of prime importance. His job is not merely to discriminate species but to illuminate them (Epling, '44, Anderson and Ownbey, '39, Anderson and Whitaker, '34). He must go beyond the cataloguing of a few outstanding differences and attempt to comprehend how the hiatus between two species came into being and how it is maintained. Internode patterns are reflections of internal growth-regulating systems. A comparison of patterns in different species or races may give us a real insight into the dynamics of these differences. The simple method outlined above may actually bring us closer to understanding fundamental physiological differences than would a series of chemical analyses. In this way it might be generally useful in various theoretical and practical problems.

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A MONOGRAPHIC STUDY OF THE GENUS PALAFOXIA AND ITS IMMEDIATE ALLIES[1]

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Introduction

It has been the purpose of this study to evaluate taxonomically on the basis of morphological examination the generic and specific entities involved in *Palafoxia* and its immediate allies, southern United States and Mexican representatives of the tribe Helenieae in the Compositae. Early in the history of the group considered, it was recognized that more than one generic element was present in this complex of related plants, but the exact nature and scope of these units were not known. There have been many different interpretations of the generic relationships and considerable shifting of the species from one genus to another without satisfactory results.

From the present study it is concluded that there are three distinct genera in the group, namely, *Othake*, *Polypteris*, and *Palafoxia*, and that in the last genus two elements are enough different to substantiate division into two subgenera.

The second part of this problem has been to determine the generic relationships of the species involved and to examine their validity. In *Othake* delimitation of the species has been unsatisfactory because of the great variability of the plants; certain species have been based on specimens which more thorough collecting proves to be extreme forms scarcely equal in rank to the recognized entities. It has therefore seemed advisable to reduce two species to varietal rank and to place another in synonymy. A somewhat similar situation in *Palafoxia* warrants the reduction of a species to a variety.

Morphological examination was based on herbarium material in the Missouri Botanical Garden and on living material observed and collected in Texas by the writer. Type specimens and additional material were obtained from the Gray Herbarium, the Academy of Natural Sciences of Philadelphia, the New York Botanical Garden Herbarium, and the S. M. Tracy Herbarium of A. and M. College, College Station, Texas.

It is with sincere appreciation that the kindness and assistance of Dr. Jesse M. Greenman is acknowledged. To Dr. George T. Moore, for the facilities of the library and the herbarium, and to Mr. H. B. Parks, for many specimens from Texas, thanks are also expressed.

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[1] An investigation carried out in the graduate laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University.

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Taxonomic History

Since it would be impossible to relate the history of any one of these three genera without continually referring to that of the other two, it seems best to present as a single unit the changing historical positions and inter-relationships of the genera concerned.

Palafoxia, named for the Spanish general, José Palafox, was the first genus of this complex to be described. In 1816 Lagasca[1] gave this name to a plant from "New Spain," which was grown in the Royal Gardens at Madrid and which Cavanilles had at first called *Ageratum lineare*[2] and afterwards transferred to *Stevia*[3]. Later in the year 1816 Cassini published the genus *Paleolaria*[4], based on Lagasca's plant, but did not actually describe the type species until 1818. At that time he placed *Palafoxia linearis* in synonymy under his *Paleolaria carnea*[5], which, along with the generic name, cannot be retained because of the priority of the earlier name.

With the publication of the genus *Polypteris*[6] together with its Floridian type species, *P. integrifolia*, by Nuttall in 1818, an element closely related to the first-mentioned plant was introduced. The similarity caused Lessing[7] in his 'Synopsis Generum Compositarum' to include both genera under *Paleolaria*, which he recognized in preference to *Palafoxia*. Regarding the species, he says, "*Paleolaria carnea* Cass. = *Palafoxia linearis* Lag." and "*Paleolaria fastigiata* Less. = *Polypteris integrifolia* Nutt."

The next allied plant recorded in the literature was from Arkansas and was described by Nuttall as *Stevia callosa*[8] in 1821. DeCandolle[9], in his 'Prodromus' (1836), transferred this species to *Florestina* and included under the genus *Palafoxia: P. linearis, Polypteris integrifolia* as *Palafoxia fastigiata*, in addition to two new species. Under the name *Polypteris integrifolia* Nutt. he placed a plant with entirely different generic affinities.

In 1836 also Rafinesque[10] based a new genus on Nuttall's *Stevia callosa* and named the entity *Othake*, separating it from existing genera chiefly on the nature of the involucral bracts and the "deep-cut florets." This name was not employed till later, however, for the species involved were for some time referred to *Palafoxia, Polypteris*, or distributed between the two genera.

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[1] Lag. Elench. Pl. Hort. Matr. 26. 1816.
[2] Cav. Ic. 3:3, *t.* 205. 1794.
[3] Cav. Praelect. n. 464, and Ic. 4:32. 1797.
[4] Cass. in Bull. Soc. Phil. 198. 1816.
[5] Cass. in Bull. Soc. Phil. 47. 1818.
[6] Nutt. Gen. N. Am. Pl. 2:139. 1818.
[7] Less. Syn. Comp. 155. 1832.
[8] Nutt. in Jour. Acad. Nat. Sci. Phila. I. 2:121. 1821.
[9] DC. Prodr. 5:124, 655, 659. 1836.
[10] Raf. New Fl. Am. 4:73. 1836.

Torrey and Gray[11], in 1842, united the scattered, related elements under three sections of the single genus *Palafoxia:* 1. *Eupalafoxia,* 2. *Florestinaria,* and 3. *Polypteris.* Bentham and Hooker[12], in 1873, followed the same interpretation and located *Palafoxia* in the subtribe Baerieae of the tribe Helenioideae.

In 1883 Dr. Gray [13] maintained that the separation of *Palafoxia* and *Polypteris* was substantiated by the nature of the involucral bracts and the corolla characters. Nuttall's *Stevia callosa,* with its immediate allies, and *P. integrifolia* were referred to the genus *Polypteris; Palafoxia linearis* and the anomalous Floridian species, *P. Feayi,* were retained in *Palafoxia* and included in the Helenieae of the Helenioideae. Hoffmann's[14] treatment of the Compositae (1891) reunited all of the entities under *Palafoxia.*

The first monographic study of the Texas and southwestern representatives of the complex was made in 1904 by Bush[15]. He recognized Rafinesque's name, *Othake,* for the greater number of the species in the *Polypteris* group of Gray and applied the latter name to the original type-species only, *P. integrifolia.* The most complete monographic investigation has been that of Rydberg[16], who recognized three genera, *Polypteris, Othake,* and *Palafoxia,* and placed them in a separate subtribe, Palafoxianae.

General Morphology

Roots.—In *Polypteris* the numerous, slender, fibrous roots develop from a short, stout woody base of perennial duration. *Othake* and *Palafoxia* have annual taproots which may become woody and perennial under conditions favoring continued growth.

Stems.—In these three genera the stems are herbaceous throughout or suffruticose, but never entirely ligneous. The stems of *Polypteris* are either simple or sparingly branched below the inflorescence; those of *Palafoxia* are extensively branched throughout; both of these conditions are represented by the species of *Othake.* In the nature of the pubescence and the glandular element the genera differ. In *Polypteris* the stem is strigillose and eglandular, while the stems of *Othake* and *Palafoxia,* with a few exceptions, are strigose-hirtellous or strigose-hirsute and densely glandular above.

Leaves.—The leaves in the three genera are quite similar, being alternate or the lower ones opposite, and usually narrowed at the base into a short petiole; they vary in shape from linear to ovate-lanceolate and are entire. Three nerves are usually visible, or the two fainter lateral ones may be indistinct because of the dense pubescence. A small, yellowish callosity is found at the apex.

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[11] Torr. & Gray, Fl. N. Am. **2**:368. 1842.
[12] Benth. & Hook. Gen. Pl. **2**:405. 1873.
[13] Gray in Proc. Am. Acad. **19**:30. 1883.
[14] Hoffm. in Engl. & Prantl, Die Nat. Pflanzenfam. IV, Abt. 5, p. 261. 1891.
[15] Bush in Trans. Acad. Sci. St. Louis **14**:173. 1904.
[16] Rydb. in N. Am. Fl. **34**[1]:58. 1914.

Pubescence.—The hairs on the vegetative parts of these plants are multicellular, tuberculate, and usually coarse. *Othake* is characterized by a strigose-hirtellous type of indument, which is found on the stems, leaves, and involucre. The peculiar type of capitate, glandular hair found among the other hairs in *Othake* is best illustrated in *O. callosum*, where the large, mushroom-shaped structures with purplish glandular caps are conspicuous. The hair bases and adjacent cells are usually distended and somewhat glandular. In *Palafoxia* the pubescence is similar but more hispid, and the glandular hairs have larger bases and smaller glandular tips. *Polypteris* is strigillose and eglandular.

Inflorescence.—In *Polypteris* there is a single corymbiform cluster of many discoid heads terminating the stem. In *Palafoxia* cymose or corymbiform clusters of a few discoid heads are borne at the ends of the branches. In *Othake* both of these conditions occur, and the heads are either discoid or radiate.

Involucre.—The involucral bracts are 2–3-seriate, but in other characteristics they are strikingly different in the three genera. In *Polypteris* the bracts are papery and membranaceous; they are flat, obtuse to truncate, almost glabrous, and several of the shorter outer bracts are reflexed. The bracts of *Othake* are herbaceous, densely pubescent, often glandular, with an irregular, dry, reddish tip, and at times show a tendency to embrace the marginal achenes at maturity. In the typical *Palafoxia* the involucre is entirely herbaceous and glandular-pubescent, the bracts being acute, subequal, keeled, and closely clasping the mature marginal achenes. In the last two genera the innermost bracts are often narrowed, thin, and hyaline-margined. The involucres of *Othake* and *Polpyteris* are turbinate, while those of *Palafoxia* are oblong-conic.

Receptacle.—A small, flat, naked and pitted receptacle with irregular aggregations of tissue around the base of the achenes is characteristic of all three genera.

Corollas.—The nature of the corolla separates *Othake* and *Polypteris* from *Palafoxia*. In *Palafoxia* the floret has a long, cylindraceous throat which exceeds the 5 short lobes and tube. *Polypteris* and *Othake* have florets with 5 long, spreading lobes, a filiform tube, and a short campanulate throat, which in *Othake* is often indistinguishable. The lobes in all the genera are usually thickened at the tip, puberulent without, and minutely papillose on the inner surface of the entire lobe. The tube is glabrous, puberulent, or glandular-puberulent, and dilated at the base. The ray florets of the heterogamous species of *Othake* are pistillate, fertile, and have deeply 3-lobed ligules. The style branches are revolute or spreading, papillose to hispidulous on the outer surface, and with 2 stigmatic lines on the inner faces. In color the florets vary from flesh to rose.

Achenes.—The achenes of *Polypteris* are 4–5-angled with unequal faces. Those of *Othake* and *Palafoxia* are square in cross-section. In *Polypteris* and *Othake*, the achenes are obpyramidal and often arcuate because of the pressure of adjacent achenes; in *Palafoxia* they are linear or somewhat obpyramidal and straight. Only one species in the group has glabrous achenes, *O. Lindenii*; in the

others, the degree of pubescence varies from hirsute to puberulent.

Pappus.—The pappus-scales vary greatly in the three genera and exhibit both generic and specific differences, but the same general type of scale is present throughout, namely, a callose midrib, broad at the base and narrowed upward, with scarious, hyaline margins. In *Polypteris* and *Othake* the midrib is slender and does not exceed the throat in length, while in *Palafoxia* it is stiff and broad and almost the length of the corolla. In *Othake* the length and shape of the scale and the nature of the apex assist in differentiating the species; also, in certain species with homogamous heads, the pappus-scales of the marginal florets are often reduced, as they are consistently in the ray florets of the heterogamous heads.

Geographical Distribution

The representatives of this group are found chiefly in Florida and the southwestern United States. *Polypteris* is limited in its distribution to Florida and southern Georgia. Species of *Othake* have their center of distribution in Texas but extend northeast to Missouri, south to Mexico, and northwest to Colorado. *Palafoxia* is represented in Florida by one species, and the remainder of the genus occurs in southwestern United States and Mexico.

Abbreviations

The herbaria from which specimens have been cited are indicated by the following abbreviations: Missouri Botanical Garden (MBG); Herbarium of the Academy of Natural Sciences, Philadelphia (ANSP); Gray Herbarium of Harvard University (G); Herbarium of the New York Botanical Garden (NYB); S. M. Tracy Herbarium of the A. and M. College, College Station, Texas (SMT).

Taxonomy

KEY TO THE GENERA

A. Heads radiate or discoid; lobes and tube of the corolla much longer than the throat.
  B. Involucral bracts herbaceous with membranaceous, reddish tips ..... Othake
  BB. Involucral bracts membranaceous and papery, sub-stramineous ..... Polypteris
AA. Heads discoid; lobes and tube of the corolla much shorter than the throat ..... Palafoxia

OTHAKE

Othake Raf. New Fl. Am. 4:73. 1836; Bush in Trans. Acad. Sci. St. Louis **14**:173. 1904; Wooton & Standley in Contrib. U. S. Nat. Herb. **19**:722. 1915; Rydb. in N. Am. Fl. **34**[1]:58. 1914, Fl. Rocky Mts. & Adj. Plains, 944. 1917, and Fl. Prairies & Plains Cent. N. Am. 854. 1932.

Stevia Nutt. in Jour. Acad. Nat. Sci. Phila. **2**:121. 1821, not *Stevia* Cav. Ic. 4:32, *t.* 342-356. 1797.

Palafoxia DC. Prodr. **5**:124. 1836, in part, not *Palafoxia* Lag. Gen. et Sp. Nov. 26. 1816; Torr. & Gray, Fl. N. Am. **2**:368. 1842, in part; Benth. & Hook.

Gen. Pl. 2:405. 1873, in part; Hoffm. in Engl. & Prantl, Die Nat. Pflanzenfam. IV, Abt. 5, p. 261. 1891.

Florestina DC. Prodr. 5:655. 1836, in part, not *Florestina* Cass. in Bull. Soc. Phil. 175. 1815.

Polypteris Gray in Proc. Am. Acad. 19:30. 1883, in part, and Syn. Fl. N. Am. 1^2:74, 337. 1884, and ed. 2. 1886, in part; Chapman, Fl. South. U. S., ed. 3, 261. 1897, in part; Small, Fl. Southeast. U. S., 1287. 1903, and ed. 2, 1913, in part; Gray, Manual, ed. 7, 843. 1908.

Herbaceous, caulescent annuals, occasionally woody at the base and perennial. Stem usually solitary from a stout tap-root, branched, strigose, usually glandular above. Leaves alternate or the lower opposite, entire, thick, 1–3-nerved. Heads discoid or radiate in corymbiform clusters terminating the branches. Involucre turbinate, the bracts in 2–3 series, subequal, the somewhat shorter outer bracts not reflexed, herbaceous and green with a sphacelate, reddish tip, and tending occasionally to enfold the marginal achenes. Receptacle flat, naked, and pitted. Corollas reddish-pink, those of the disc-florets perfect, regular, deeply 5-lobed, the lobes and filiform tube at least twice as long as the short, campanulate throat. Ray-florets, when present, in one cycle, pistillate and fertile, deeply 3-lobed. Stamen-tube completely exserted, the anthers obtuse at the base. Style-branches linear, spreading or revolute, hispidulous. Achenes 4-angled, obpyramidal. Pappus of 7–10 scales, varying from a minute callosity to a long, acuminate, hyaline-margined callose midrib exceeding the corolla-tube, the squamallae of the ray-florets of the radiate heads and often of the marginal florets of the discoid heads reduced.

Type species: *Othake tenuifolium* Raf. New Fl. Am. 4:73. 1836 (= Othake callosum (Nutt.) Bush).

KEY TO THE SPECIES

A. Heads discoid.
  B. Pappus-scales 0.5–3.0 mm. long, exceeded by the achenes, the scales of the marginal achenes not reduced in size.
    C. Pappus-scales less than 1.5 mm. long, obtuse; florets 7–12 in a head; leaves 1–2 mm. wide ..... 1. O. CALLOSUM
    CC. Pappus-scales 2–3 mm. long, acute or obtuse; florets 12 or more in a head; leaves more than 3 mm. wide.
      D. Plants slender, florets 12–20 in a head; leaves 3–5 mm. wide ..... 2. O. ROSEUM
      DD. Plants stout, florets about 25, occasionally more, leaves 0.7–1.5 cm. wide ..... 2a. O. ROSEUM var. ROBUSTUM
  BB. Pappus-scales 3.5–8.0 mm. long, equalling or exceeding the achenes, rarely shorter, the scales of the marginal achenes often reduced in size.
    E. Achenes distinctly pubescent.
      F. Pappus-scales acute, 3.5–4.5 mm. long, peduncles sparingly glandular-pubescent ..... 3. O. TEXANUM
      FF. Pappus-scales acuminate, 6–8 mm. long, peduncles distinctly glandular-pubescent ..... 3a. O. TEXANUM var. MACROLEPIS
    EE. Achenes glabrous, or nearly so ..... 4. O. LINDENII

AA. Heads radiate.
G. Plants slender; leaves linear, 2–6 mm. wide, florets 9–12 in a head ..... 5. O. REVERCHONII
GG. Plants stout, leaves lanceolate, 0.5–1.5 cm. wide, florets 20–70 in a head.
H. Stem branched, florets 20–30, glandular-pubescent on the peduncles only ..... 6. O. SPHACELATUM
HH. Stem simple, florets 60–70, the entire plant usually glandular-pubescent and somewhat viscid ..... 7. O. HOOKERIANUM

1. Othake callosum (Nutt.) Bush in Trans. Acad. Sci. St. Louis **14**:174. 1904; Britt. & Brown, Illust. Fl. **3**:507, *fig. 4535*. 1913; Rydb. in N. Am. Fl. **34**[1]:59. 1914.

Othake tenuifolium Raf. New Fl. Am. **4**:74. 1836.

Stevia callosa Nutt. in Jour. Acad. Nat. Sci. Phila. I. **2**:121. 1821, and in Linnaea **4**:40. 1829; Barton, Fl. N. Am. **2**:31, *t. 46*. 1822.

Florestina callosa DC. Prodr. **5**:655. 1836.

Palafoxia callosa (Nutt.) Torr. & Gray, Fl. N. Am. **2**:369. 1842; Walp. Rep. Bot. Syst. Suppl. **1**:949. 1843.

Polypteris callosa (Nutt.) Gray in Proc. Am. Acad. **19**:30. 1883, and Syn. Fl. N. Am. **1**[2]:337. 1884, and ed. 2. 1886; Coulter in Contrib. U. S. Nat. Herb. **2**:230. 1892.

A slender, herbaceous annual; stem 1–5 dm. high, somewhat geniculate, terete, canescent-strigose, finely furrowed, somewhat shining below; leaves sessile or nearly so, linear to lanceolate-linear, 3–5 cm. long, 1–2 mm. broad, obtuse, narrowed at the base, strigose and hispidulous on both surfaces, 1(–3)-nerved; peduncles slender, minutely strigose, densely glandular-pubescent with large purple-tipped hairs; heads numerous, about 1 cm. high; involucral bracts 7–9, linear to oblong-lanceolate, about 5 mm. long, acute to acuminate, slightly fimbriate at the apex, strigose, eglandular or with a few capitate-glandular hairs; florets 7–12 in a head; corolla-lobes linear, 3.5 mm. long, obtuse to acutish, the tips pubescent without; throat campanulate, very short, about 0.5 mm. long, glabrous; tube slender, somewhat expanded at the base, 2.0–2.5 mm. long, pubescent, sparingly glandular; achenes 3–4 mm. long, puberulent; pappus-scales 8–9, subequal, varying from a minute, blunt, callose midrib to a broadly ovate scale 1 mm. or less long, with an erose hyaline margin and a glabrous included rib.

Distribution: southern Missouri to Texas.

MISSOURI: Greene Co., Sept. 4, 1893, *Bush 203* (MBG); Eagle Rock, Barry Co., Sept. 17, 1896, *Bush 115* (MBG); barrens, Swan, Sept. 24, 1899, *Bush 476*, and Sept. 22, 1905, *3354* (MBG); barrens, Eagle Rock, Aug. 9, 1905, *Bush 3187* (MBG); gravelly bars, Noel, Aug. 7, 1908, *Bush 4983* (MBG); barrens, Barry Co., July 16, 1935, *Bush 14999* (MBG); dry ground, Baxter, Sept. 10, 1935, *Bush 15180* (MBG); gravelly places, Barry Co., Sept. 10, 1935, *Bush 15190* (MBG); rocky banks, Stone Co., Sept. 11, 1935, *Bush 15195* (MBG); bottoms, Barry Co., Sept. 22, 1936, *Bush 15756* (MBG); common in barrens, Eagle Rock, Barry Co., Sept. 17, 1898, *Mackenzie* (MBG); gravelly bars, Noel, Aug. 7, 1908, *Palmer 4893*, Sept. 2, 1913, *4078*, and Sept. 11, 1920, *19067* (MBG); rocky ledges, barrens, Galena, Stone Co., Oct. 11, 1913, *Palmer 4633* (MBG); rocky

terraces of "bald knobs," Roark, Stone Co., Sept. 28, 1920, *Palmer 19204* (MBG); sandstone glades, top of bluff along river, near Tecumseh, Ozark Co., Oct. 8, 1927, *Palmer 33012* (MBG); Wilson Creek, Green Co., *Shepard* (MBG); upland open places bordering limestone glade, 2 mi. w. of Richville, Douglas Co., Aug. 19, 1934, *Steyermark 14657* (MBG).

Arkansas: barrens, Benton Co., Sept. 9, 1936, *Bush 15752* (MBG); barrens, Oakgrove, Oct. 7, 1936, *Bush 15942* (MBG); along railroad track, Gilbert, Searcy Co., Aug. 5, 1913, *Emig 43* (MBG); without definite locality, *Nuttall* (ANSP), type; Red River, *Nuttall* (ANSP); barrens, rocky hillsides, Beaver, Carroll Co., Sept. 26, 1913, *Palmer 4492* (MBG); Eureka Springs, Aug. 1887, *Wislizenus* (MBG).

Oklahoma: roadside clay soil, 6 mi. s. of Elk City, Beckham Co., Oct. 17, 1936, *Eskew 1502* (MBG).

Texas: rocky soil, s. of San Antonio, Bexar Co., June 25, 1938, *Ammerman 8*, and rocky soil near Kerrville, June 30, 1938, *39* (MBG); Dallas, common on hills, Sept. 26, 1900, *Bush 1146*, and common in barrens, Oct. 30, 1900, *1635* (MBG); 1.5 mi. n. of Leona, Leon Co., Oct. 5, 1937, *Cory 25366* (MBG); dry hills in Jacksonville, Cherokee Co., Aug. 29, 1898, *Eggert* (MBG); between Sheffield and Pecos River, Pecos Co., July 23, 1921, *Ferris & Duncan 2915* (MBG); sandy woods and fields, Dallas, June 20, 1872, *Hall 356* (MBG); Willow Creek, Gillespie Co., *ex Herb. Jermy 804* (MBG); Denison, July 22-25, 1880, *Letterman* (MBG); Comanche Spring, Nov. 1849, *Lindheimer 956*, and New Braunfels, 1851, *955* (ANSP, MBG); dry, calcareous soil, Comanche Peak near Granbury, Hood Co., Sept. 15, 1914, *Palmer 6443a* (MBG); rocky open ground, Kerrville, Kerr Co., Oct. 5, 1916, *Palmer 10898* (MBG); gravel bars of river, Blanco, Blanco Co., Sept. 24, 1917, *Palmer 12856* (MBG); dry, calcareous open ground, near Brownwood, Brown Co., Nov. 1, 1925, *Palmer 29531* (MBG); Bexar Co., Sept. 8, 1938, *Parks* (MBG); 1.5 mi. w. of Mountain Home, Kerr Co., Oct. 1, 1936, *Parks & Cory 20747 & 20748* (SMT); dry ground, Dallas, Oct. 1, 1902, *Reverchon* (MBG); dry uplands, Oak Cliff, Oct. 16, 1902, *Reverchon 3288* (MBG); limestone prairies, Dallas, Oct. 16, 1902, *Reverchon* (MBG); on rocks, Comanche Peak, Sept. 1903, *Reverchon 3655* (MBG); Weatherford, Oct. 18, 1902, *Tracy 8142* (MBG).

2. Othake roseum Bush in Trans. Acad. Sci. St. Louis **14**:175. 1904; Rydb. in N. Am. Fl. **34**[1]:59. 1914.

Polypteris rosea (Bush) Small, Fl. Southeast. U. S., ed. 2, 1372. 1913.

A slender, herbaceous annual; stem 3–6 dm. high with a few ascending branches, terete, strigose, somewhat scabrous, finely furrowed, cinereous; leaves petiolate, linear-lanceolate, 4–6 cm. long, 3–5 mm. broad, obtuse, narrowed at the base, scabrous on both surfaces, 1(–3)-nerved; peduncles slender, long, finely glandular; involucral bracts 7–10, oblanceolate, 6–8 mm. long, acute to obtuse, strigose, eglandular; florets 12–20 in a head; corolla-lobes linear, 4 mm. long, the tips pubescent without; throat campanulate, very short, about 0.5 mm. long, glabrous; tube slender, dilated at the base, 4 mm. long, minutely glandular-puberulent; achenes 3–4 mm. long, pubescent; pappus-scales about 8, ovate-lanceolate, about 2 mm. long, acute or obtuse, the midrib dorsally pubescent, the hyaline margins erose, scales of the marginal achenes scarcely reduced.

Distribution: Texas.

Texas: about 2 mi. s. of College Station, Brazos Co., June 22, 1938, *Ammerman 7* (MBG); Houston, Oct. 25, 1900, *Bush 1599* (MBG); sandy ground near Dallas, June 24, 1899, *Eggert* (MBG); along Devils River, Valverde Co., Sept. 10, 1900, *Eggert* (MBG); Dallas, June 16, 1898, *Glatfelter* (MBG); Galveston Bay, Sept. 26, 1884, *Joor* (MBG);

banks of Buffalo Bayou, near Houston, Oct. 1841, *Lindheimer* (MBG); wet prairies, Houston, Aug. 1842, *Lindheimer* (MBG); dry open ground, Houston, Harris Co., Sept. 16, 1915, *Palmer 8575* (MBG); prairies, Bryan, Brazos Co., Sept. 17, 1916, *Palmer 10732* (ANSP, MBG); College Station, Brazos Co., July, 1888, *Pammel* (MBG); Newland, near Dallas, June 6, 1901, *Reverchon 2577*, and sands, Dallas, May 1, 1902, *3290* (MBG); Buzzards Spring, Aug. 7, 1902, *Reverchon 3290* (MBG); Sheldon, Sept. 20, 1903, *Reverchon 3656*, and Oct. 7, 1903, *3656* TYPE (MBG); Millett, Nov. 4, 1897, *Trelease* (MBG); Willis, Aug.-Sept., *Warner* (MBG).

2a. Othake roseum var. **robustum** (Rydb.) Ammerman, comb. nov.

O. robustum Rydb. in N. Am. Fl. **34**[1]:60. 1914.

Polypteris robustum (Rydb.) Cory in Rhodora **38**:408. 1936.

Stem 3–7 dm. high, stout, often ligneous below; leaves lanceolate to ovate-lanceolate, 4–8 cm. long, 0.7–1.5 cm. wide, indistinctly 3-nerved; peduncles glandular; florets about 25, occasionally more, in a head; as the species in other characters.

Distribution: southern Texas, south to Tamaulipas, Mexico.

TEXAS: Corpus Christi Bay, Nueces Co., *Heller 1562* (MBG); Highway 35, Aransas Co., Highway 181, Bee Co., and Highway 181, Bexar Co., Sept. 9, 1938, *Parks* (MBG); Karnes Co. and Refugio Co., Sept. 9, 1938, *Parks* (MBG); Highway 181, San Patricio Co., and Highway 77, Victoria Co., Sept. 9, 1938, *Parks* (MBG); Wilson Co., Sept. 8, 1938, *Parks* (MBG); 12 mi. s. e. of Hebbronville, Jim Hogg Co., Oct. 7, 1935, *Parks & Cory, 16941 & 16942* (SMT); seashore at Rockport, July, 1893, *Reverchon 1230* (MBG); Brownsville, Aug. 1, 1923, *Runyon 209* (MBG).

MEXICO:

TAMAULIPAS: dunes, Tampico, Nov. 24, 1937, *Kenoyer 728* (MBG); vicinity of Tampico, Jan. 1-31, 1910, *Palmer 38* (MBG); sand-dunes of Gulf coast, Tampico, July 4, 1896, *Pringle 6354* (MBG), CO-TYPE.

3. Othake texanum (DC.) Bush, Trans. Acad. Sci. St. Louis **14**:176. 1904; Rydb. in N. Am. Fl. **34**[1]:59. 1914; Wooton & Standley, Contrib. U. S. Nat. Herb. **19**:722. 1915.

O. canescens Rydb. in N. Am. Fl. **34**[1]:60. 1914.

Palafoxia Texana DC. Prodr. **5**:125. 1836, not Hook. Ic. Pl. *t. 148*. 1837; Dietrich, Syn. Pl. 1345. 1847; Torr. & Gray, Fl. N. Am. **2**:369. 1842; Hemsl. Biol. Cent.-Am. Bot. **4**:59. 1886.

Polypteris Texana (DC.) Gray in Proc. Am. Acad. **19**:30. 1883, and Syn. Fl. N. Am. **1**[2]:337. 1884, and ed. 2. 1886; Small, Fl. Southeast. U. S., 1287. ed. 1. 1903, and ed. 2. 1913.

An herbaceous, rather stout annual, occasionally woody below and perennial; stem 3–5 dm. high, much-branched, terete, strigose, shallowly furrowed; leaves petiolate, linear-lanceolate to ovate-lanceolate, 3–5 cm. long, 0.3–1.0 cm. broad, obtuse, strigose on both surfaces, narrowed or somewhat rounded at the base, 3-nerved, petiole 4–6 mm. long; peduncles rather stout, strigose and somewhat glandular, but not densely so; heads numerous, 1.0–1.5 cm. high; involucral bracts 12–15, linear-lanceolate, acute to obtuse, about 9 mm. long, strigose, eglandular; florets 25–30 in a head; corolla-lobes linear, 3–4 mm. long, the tips pubescent without; throat short, campanulate, about 0.5 mm. long; tube slender,

dilated at the base, about 3 mm. long, finely glandular-pubescent; achenes 4.5–6.0 mm. long, pubescent; pappus-scales 6–8, obovate, 3.5–4.5 mm. long, acute, erose, the midrib dorsally pubescent, the pappus of the outer achenes shorter, 1.0–1.5 mm. long, and obtuse.

Distribution: Oklahoma, Texas, and northern Mexico.

OKLAHOMA: Johnson's Pasture, McClain Co., June 26, 1937, *Barkley 1499* (MBG); vicinity of Fort Sill, July 14, 1916, *Clemens 11844* (MBG).

TEXAS: south of San Antonio, Bexar Co., June 18, 1938, *Ammerman 97* (MBG); from Laredo to Bexar, *Berlandier 604, 2014* CO-TYPE (MBG); in low area, 1 mi. e. of Cotulla, LaSalle Co., July 30, 1921, *Ferris & Duncan 3014* (MBG); escarpment of Staked Plains on Quitaque-Plainview Rd., Floyd Co., Aug. 23, 1921, *Ferris & Duncan 3375* (MBG); Spofford, May 8-9, 1904, *Griffiths 6320* (MBG); Del Rio, April 21, 1930, *Jones 26398*, Carriso Spring, April 26, *28008*, and Laredo, March 24, 1932, *29467* (MBG); sandy bluffs near Laredo, Aug., 1899, *Mackenzie 7* (MBG); Laredo, Feb. & March, *Orcutt 5548* (MBG); sandy, open ground, Pleasanton, Atascosa Co., Sept. 23, 1916, *Palmer 10782* (MBG); Sutherland Springs, Wilson Co., July 10, 1938, *Parks & Ammerman 62* (MBG); Del Rio, Val Verde Co., April 18, 1935, *Parks & Cory 12290* (SMT); south-central Wilson Co., April 19, 1935, *Parks & Cory 12401*, and 11 mi. s. of Catarina, Dimmit Co., Oct. 7, 1935, *16946* (SMT); sandy plains, Laredo, July 24, 1889, *Pringle 2655* (MBG).

MEXICO:

NUEVO LEON: Sabinas Hidalgo, Sept. 16, 1936, *Kenoyer* (MBG); C. P. Diaz, April 18, 1900, *Trelease 66* (MBG).

COAHUILA: between Hipolito and Sacramento along a dry creek bed in El Desierto de la Payla, Ramos Arizpe, June 15, 1936, *Wynd & Mueller 83*, and San Lazaro, near n. entrance of El Puerto de San Lazaro, Castanos, June 16, 1936, *120* (MBG).

3a. Othake texanum var. **macrolepis** (Rydb.) Ammerman, comb. nov.

O. macrolepis Rydb. in Bull. Torr. Bot. Club. **37**:332. 1910, and in N. Am. Fl. **34**[1]:60. 1914, Fl. Rocky Mts. & Adj. Plains, 944. 1917, and Fl. Prairies & Plains Cent. N. Am. 854. 1932.

Polypteris macrolepis (Rydb.) Cory in Rhodora **38**:408. 1936.

Stem herbaceous, 1.5–4.0 dm. high; leaves linear-lanceolate to lanceolate; peduncles glandular-pubescent; achenes about 6 mm. long, canescent-pubescent; pappus-scales about 8, ovate-lanceolate, 6–8 mm. long, attenuate-acuminate; in other characters as the species.

Distribution: Wyoming and Colorado.

WYOMING: sandy knoll, T. 38N., R. 67W., n. e. Converse Co., June 25, 1936, *Ownbey 1051* (MBG, NYB).

COLORADO: Rule Creek, Bent Co., Aug. 17, 1909, *Osterhout 4097* TYPE, and June 10, 1910, *4314* (NYB).

4. Othake Lindenii (Gray) Bush in Trans. Acad. Sci. St. Louis **14**:173. 1904; Rydb. in N. Am. Fl. **34**[1]:60. 1914.

Palafoxia Lindenii Gray, Smiths. Contrib. to Knowledge (Pl. Wright. Pt. 1) **3**:120. 1852; Walp. Ann. Bot. Syst. **5**:161. 1858.

Polypteris Lindenii Gray in Proc. Am. Acad. **19**:30. 1883.

A simple or sparingly branched herbaceous annual; stem 4–7 dm. high, strigillose throughout, shallowly furrowed, gray-brown; leaves petiolate, oblong-

lanceolate to elliptic, 4–6 cm. long, 5–7 mm. broad, obtuse, narrowed at the base, puberulent on both surfaces, thick, obscurely 3-nerved, petioles 0.7–1.0 cm. long, expanded at the base; peduncles rather stout, long, densely glandular; heads few, about 1.7 cm. high; involucral bracts 11–15, linear to oblanceolate, about 9 mm. long, acute to obtuse, somewhat fimbriate at the apex, strigose, glandular; florets 18–25 in a head; corolla-lobes linear, 4 mm. long, acute to obtuse, somewhat pubescent at the tips; throat cylindric-campanulate, 1.5 mm. long, glabrous; tube slender, expanded at the base, 4.5 mm. long, not pubescent, finely glandular; achenes about 7 mm. long, glabrous or nearly so; pappus-scales 9–10, ovate-lanceolate, 4–6 mm. long, obtuse, the callose rib glabrous and extending to the tip of the scale, the hyaline margin erose near the apex.

Distribution: southern Mexico.

MEXICO:

VERA CRUZ: near the shore, n. of Vera Cruz, Jan. 24, 1906, *Greenman 95* (G); Gulf Coast, Sept. 1912, *Purpus 6025* (MBG, G); Antigua, June, 1838, *Linden*, fragments of TYPE, and Vera Cruz, sand-hills near the sea, 1840, *Galeotti 2627* (G).

5. Othake Reverchonii Bush in Trans. Acad. Sci. St. Louis **14**:180. 1904.

Polypteris Reverchonii (Bush) Small, Fl. Southeast. U. S., ed. 2, 1373. 1913.

A slender, herbaceous annual; stem 3–5 dm. high, simple below, with a few spreading branches above, terete, strigose, eglandular or minutely glandular in the upper parts, furrowed; leaves petiolate, linear to lanceolate-linear, 4–6 cm. long, 2–6 mm. broad, acute, narrowed at the base, slightly scabrous on both surfaces, 1-nerved, rarely 3-nerved, petioles 5–7 mm. long; peduncles long, slender, divaricate, strigose, eglandular or finely glandular; heads few, 1.0–1.4 cm. high; involucral bracts 7–9, oblanceolate, about 9 mm. long, acute or obtuse and somewhat fimbriate at the apex; ray-florets 4–6, the limb deeply 3-lobed, about 8 mm. long, the tube slender, densely glandular-pubescent, about 5 mm. long; disc-florets 5–6, the corolla-lobes 3 mm. long, linear; the cylindraceous, glabrous throat 2 mm. long; the tube 4 mm. long, slender, finely glandular-pubescent; achenes 5 mm. long, pubescent; pappus-scales 8, those of the ray-florets obovate, about 0.6 mm. long, obtuse, erose, those of the disc florets lanceolate, about 5 mm. long, lacerate-erose near the apex, the midrib dorsally pubescent.

Distribution: eastern Texas.

TEXAS: 2 mi. s. of Grapeland, Houston Co., Oct. 12, 1937, *Cory 26155* (MBG); Cherokee, Oct. 31, 1884, *Joor* (MBG); dry sands, Big Sandy, Upshur Co., Sept. 27, 1926, *Palmer 31756*, and Sept. 16, 1902, *Reverchon 3289* TYPE (MBG).

6. Othake sphacelatum (Nutt. ex Torr.) Rydb. in Bull. Torr. Bot. Club **37**:331. 1910, and Fl. Rocky Mts. and Adj. Plains, 944. 1917; Britt. & Brown, Illust. Fl. **3**:507, *fig. 4534*. 1913; Wooton & Standley in Contrib. U. S. Nat. Herb. **19**:722. 1915.

Stevia sphacelata Nutt. ex Torr. in Ann. Lyc. N. Y. **2**:214. 1828.[17]

[17] A specimen of O. *callosum* in the Herbarium of the Academy of Natural Sciences of Philadelphia, bearing the label *Stevia sphacelata* in Nuttall's handwriting, indicates that Nuttall probably intended to give the latter name to his *S. callosa*. The confused history of the name *S. sphacelata* is set forth by Rydberg in the Bull. Torr. Bot. Club **37**:331. 1910.

Palafoxia Hookeriana β. subradiata Torr. & Gray, Fl. N. Am. **2**:368. 1842; Gray in Smiths. Contrib. to Knowledge (Pl. Wright., Pt. 1) **3**:120. 1852.

Polypteris Hookeriana Gray in Proc. Am. Acad. **19**:30. 1884, in part, and Syn. Fl. N. Am. **1**^{2}:337. 1884, and ed. 2, 1886, in part; Coulter in Contrib. U. S. Nat. Herb. **2**:230. 1892, in part; Small, Fl. Southeast. U. S., 1287, ed. 1, 1903, and ed. 2, 1913; Coulter & Nelson, Man. Cent. Rocky Mts. 555. 1909.

Palafoxia Hookeriana Hooker in Curtis's Bot. Mag. **91**:*t. 5549*. 1865, not Torr. & Gray, Fl. N. Am. **2**:368. 1842.

O. Hookerianum (Torr. & Gray) Bush in Trans. Acad. Sci. St. Louis **14**:177. 1904, excluding synonymy.

An herbaceous annual; stem 3–6 dm. high, somewhat geniculate, branched throughout with ascending branches, terete, strigose, shallowly furrowed; leaves petiolate, linear-lanceolate to lanceolate, 4–6 cm. long, 0.5–1.5 cm. wide, acute to obtuse, strigose on both surfaces, 3-nerved, petioles 0.6–1.0 cm. long; peduncles rather stout, densely glandular; heads few, 1.6–2.2 cm. high; involucral bracts 9–11, oblanceolate, about 1 cm. long, acute, strigose, glandular, the outer series often herbaceous throughout, the inner bracts with sphacelate, reddish tips; ray-florets 5–8, the limb 1.0–1.5 cm. long, deeply 3-cleft, the lobes rounded, the slender, glandular-pubescent tube 6 mm. long; disc-florets 15–20, the corolla-lobes linear, about 4 mm. long, the throat cylindraceous, 2 mm. long, glabrous, the tube filiform and dilated at the base, 8 mm. long, puberulent, eglandular; achenes 7–8 mm. long, pubescent; pappus-scales about 8, those of the ray-florets obovate, 1 mm. long or less, obtuse, erose, those of the disc-florets lanceolate, 8–9 mm. long, slightly exceeding the tube, attenuate, the midrib dorsally pubescent or glabrous.

Distribution: southwestern Kansas and Colorado southward to northern Mexico.

Without definite locality: *James* (NYB), type.

Kansas: Arkalon, Oct. 23, 1892, *Carleton* (NYB); sand hills, Hamilton Co., Aug. 3, 1895, *Hitchcock 288* (MBG, NYB); Garden City, Aug. 14, 1896, *Letterman* (MBG); Arkalon, Aug. 17, 1890, *Smyth 783* (MBG); Syracuse, Hamilton Co., July 4, 1893, *Thompson 76* (NYB).

Oklahoma: Frederick, July 6, 1903, *Duncan 29* (MBG); sand-dunes, s. e. Beckham Co., Oct. 18, 1936, *Eskew 1524* (MBG); Red River bottoms, 10 mi. n. of Quanah, Texas, Aug. 21, 1921, *Ferris & Duncan 3365* (NYB); sandy soil near roadside, 3 mi. n. of Alva, Woods Co., July 19, 1934, *Goodman 2175*, and banks of the North Fork of the Red River, near Sayre, Beckham Co., Sept. 12, 1934, *2354* (MBG); sand dunes along small tributary of North Canadian River, near Beaver, Beaver Co., July 24, 1933, *Palmer 41895* (MBG); in sandy soil by Wolf Creek, near Shattuck, Ellis Co., Oct. 11, 1913, *Stevens 2908* (MBG); sandy soil by river, 1 mi. n. of Sayre, Beckham Co., Aug. 8, 1927, *Stratton 334*, and 2 mi. n. of Beaver City, Beaver Co., Aug. 20, 1927, *411* (MBG); sand hills, Cimarron R., July 12, 1899, *White 250* (MBG, NYB); Woodward Co., July 12, and July 13, 1900, *White* (MBG).

Texas: in sand desert on State Highway 51, near Crane, Crane Co., July 19, 1938, *Cutak 6* (MBG); sandy ground near the Canadian River, Hemphill Co., Aug. 10, 1900, *Eggert* (MBG); grassy sand hills, 2 mi. s. of Muleshoe, Bailey Co., Aug. 24, 1921, *Ferris*

& *Duncan 3411* (MBG, NYB); 1 mi. n. of bridge over Canadian R., Amarillo-Dalbart Rd., Oldham Co., Aug. 27, 1921, *Ferris & Duncan 3501* (MBG); along railway, Amarillo, Potter Co., July 13, 1917, *Potter 12543* (MBG); sandy open ground, along river, Canadian, Hemphill Co., June 17, 1918, *Palmer 14100* (MBG); sands, Tascosa, June 24, 1902, *Reverchon 3219* (MBG).

COLORADO: Fort Collins, Sept. 25, 1894, *Baker* (NYB); Fort Morgan, Sept. 4, 1918, *Hapeman* (MBG).

NEW MEXICO: 35 mi. w. of Roswell, Chaves Co., Aug., 1900, *Earle & Earle 381* (MBG, NYB); sand plain n. of Magdalena, Datil Forest, Socorro Co., Oct. 2, 1919, *Eggleston 16193* (MBG); sandy soil, Jemez Springs, Aug. 24, 1931, *Nelson 11680* (MBG); Carlsbad, Oct. 3, 1902, *Tracy 8163* (MBG); Mesilla, Dona Ana Co., June 17, 1897, *Wooton 28* (MBG, NYB); Mesilla Valley, Dona Ana Co., Oct. 10, 1907, *Wooton* (MBG).

MEXICO:

CHIHUAHUA: sand hills near Paso del Norte, Sept. 20, 1886, *Pringle 761* (MBG).

7. Othake Hookerianum (Torr. & Gray) Bush in Trans. Acad. Sci. St. Louis **14**:179. 1904, as to name only; Rydb. in N. Am. Fl. **34**[1]:61. 1914.

Palafoxia Texana Hook. Ic. Pl. **2**:*pl. 148*. 1837, not DC. Prodr. **5**:125. 1836.

Palafoxia Hookeriana Torr. & Gray, Fl. N. Am. **2**:368. 1842, not Hooker in Curtis's Bot. Mag. **91**:*t. 5549*. 1864; Walp. Rep. Bot. Syst. Suppl. **1**:949. 1843.

Polypteris Hookeriana (Torr. & Gray) Gray in Proc. Am. Acad. **19**:30. 1883, in part, and Syn. Fl. N. Am. **1**[2]:337. 1884, and ed. 2, 1886, in part; Coulter in Contrib. U. S. Nat. Herb. **2**:230. 1892, in part; Coulter & Nelson, New Man. Bot. Cent. Rocky Mts. 555. 1909.

Polypteris maxima Small, Fl. Southeast. U. S. 1288. ed. 1, 1903, and ed. 2, 1913.

O. maximum (Small) Bush in Trans. Acad. Sci. St. Louis **14**:179. 1904.

A stout annual; stems 4–10 dm. high, usually unbranched below the inflorescence, erect, terete, densely glandular-pubescent and usually viscid throughout, furrowed; leaves petiolate, lanceolate, 6–10 cm. long, 0.8–1.4 cm. wide, acute or acuminate, narrowed at the base, roughly scabrous on both surfaces, 3-nerved, petioles about 1.5 cm. long, densely glandular; peduncles long, stout, viscid; heads few, 2.0–2.5 cm. high; involucral bracts 15–17, oblanceolate, about 1.5 cm. long, acute, densely glandular-pubescent, the outer series usually herbaceous throughout, the inner bracts with a sphacelate, reddish tip; ray-florets 8–12, the limb deeply 3-cleft, about 1.5 cm. long, the lobes rounded, the tube slender, about 7 mm. long, glandular-pubescent; disc-florets 50–60, the lobes of the corolla linear, about 4 mm. long, the tips pubescent and somewhat glandular without, the cylindraceous, glabrous throat 2 mm. long, the slender tube about 6.5 mm. long, dilated at the base and finely glandular-pubescent; achenes 7 mm. long, pubescent; pappus-scales 8, those of the ray-florets obovate, subequal, 1 mm. or less long, acute or obtuse, the margin erose, those of the disc-florets lanceolate, subequal, 7–8 mm. long, slightly exceeding the tube, acuminate, the midrib dorsally pubescent.

Distribution: southeastern Texas.

TEXAS: Sutherland Springs, Wilson Co., July 18, 1938, and Nov. 1938, *Bremer*, and July 10, 1938, *Parks, Bremer & Ammerman* (MBG); Milano, Oct. 28, 1918, *Joor* (MBG);

Industry, Aug. 1844, *Lindheimer* (MBG); without definite locality, ex. Herb. Chapman, *Lindheimer* (NYB); sand dunes, Flour Bluff, Nueces Co., Sept. 9, 1939, *Parks* (MBG).

DOUBTFUL SPECIES

Othake tenuifolium Raf. New Fl. Am. 4:74. 1836. This plant is described by Rafinesque as being similar to O. *callosum* but having very large leaves; it could not be identified with any available specimens.

POLYPTERIS

Polypteris Nutt. Gen. N. Am. Pl. **2**:139. 1818, not Less. in Linnaea **6**:518. 1831, nor DC. Prodr. **5**:659. 1836; Ell. Sketch Bot. S. Car. & Ga. **2**:313. 1824; Gray in Proc. Am. Acad. **19**:30. 1883, in part, and Syn. Fl. N. Am. **1**^{2}:74, 337. 1884, and ed. 2, 1886, in part; Chapman, Fl. South. U. S., ed. 3, 261. 1897, in part; Small, Fl. Southeast. U. S. 1287. ed. 1, 1903, and ed. 2, 1913, in part; Bush in Trans. Acad. Sci. St. Louis **14**:172. 1904; Gray, Manual, ed. 7, 843. 1908, in part; Coulter & Nelson, New Man. Bot. Cent. Rocky Mts. 555. 1909, in part; Rydb. in N. Am. Fl. **34**^{1}:61. 1914; Small, Man. Southeast. Fl. 1462. 1933, in part.

Paleolaria Cass. in Bull. Soc. Phil. 198. 1816, in part; Less. Syn. Comp. 155. 1832, in part.

Palafoxia DC. Prodr. **5**:124. 1836, in part, not Lag. Gen. et Sp. Nov. 26. 1816, in part; Benth. & Hook. Gen. Pl. **2**:405. 1873.

Lomaxeta Raf. New Fl. Am. 4:72. 1836.

Herbaceous, caulescent perennials with long, slender, fibrous roots. Stems several from a common base, strigillose, eglandular. Leaves alternate or the lower opposite, entire, thick, 1–3-nerved. Heads discoid, in a terminal, corymbiform cluster. Involucre turbinate, the bracts 2–3-seriate, membranaceous, not enfolding the marginal achenes, several of the outer series short and spreading or reflexed. Receptacle flat, naked, pitted, the surface uneven because of irregular aggregations of tissue around the base of the achenes. Corollas regular, deeply 5-lobed, the campanulate throat shorter than the spreading lobes or the slender tube. Stamen-tube completely exserted, the anthers obtuse or rounded at the base. Style-branches linear, obtuse or somewhat acute, exserted from the stamen-tube, spreading or recurved, hispidulous. Achenes 4–5-angled, obpyramidal, pubescent. Pappus of about 10 scarious, subequal scales with a midrib extending to the tip, the squamellae of the marginal achenes not reduced.

Type species: *Polypteris integrifolia* Nutt. Gen. N. Am. Pl. **2**:139. 1818.

1. Polypteris integrifolia Nutt. Gen. N. Am. Pl. **2**:139. 1818, not DC. Prodr. **5**:659. 1836; Ell. Sketch Bot. S. Car. & Ga. **2**:314. 1824; Chapman, West. Jour. Med. & Surg. 471. 1845; Gray, Syn. Fl. N. Am. **1**^{2}:337. 1884, and ed. 2, 1886; Chapman, Fl. South. U. S. ed. 3, 261. 1897; Small, Fl. Southeast.

U. S., ed. 1, 1287. 1903, and ed. 2, 1913; Rydb. in N. Am. Fl. 34[1]:62. 1914; Small, Man. Southeast. Fl. 1462. 1933.

Hymenopappus integrifolius Spreng. Syst. 3:449. 1826.

Paleolaria fastigiata Less. Syn. Comp. 156. 1832.

Palafoxia fastigiata DC. Prodr. 5:125. 1836; Dietrich, Syn. Pl. 1345. 1847.

Lomaxeta verrucosa Raf. New Fl. Am. 4:72. 1836.

Palafoxia integrifolia Torr. & Gray, Fl. N. Am. 2:368. 1842; Walp. Rep. Bot. Syst. Suppl. 1:949. 1843; Benth. & Hook. Gen. Pl. 2:405. 1873; Hoffm. in Engler & Prantl, Die Nat. Pflanzenfam. IV, Abt. 5, p. 261. 1891.

An herbaceous perennial, woody at the base; stem 9–12 dm. high, sparingly branched below the inflorescence, erect, terete, strigillose throughout or nearly glabrous below, furrowed, brown; leaves petiolate, linear to oblong-lanceolate, 3–8 cm. long, 0.2–1.0 cm. wide, obtuse to somewhat acute, narrowed at the base, scabrous on both surfaces, dark green, the tuberculate hair-bases often white and conspicuous, petioles 3–8 mm. long; peduncles slender or slightly enlarged below the heads, strigose; heads numerous, 1.5–2.0 cm. long; involucral bracts about 15, oblong to oblong-spatulate, usually about 9 mm. long, membranaceous, truncate, rounded or obtuse, somewhat erose at the apex, flat, thin, finely scabrous or glabrous, stramineous, the short, reflexed, outer bracts 2.5 mm. long and somewhat herbaceous; florets 17–20 in a head, white or flesh-colored; corolla-lobes linear, 4 mm. long, acutish, the tips thickened and pubescent without; throat campanulate, 2 mm. long, glabrous; tube very slender, abruptly dilated at the base, 6 mm. long, pubescent; style-branches exserted about half their length from the stamen-tube; achenes 5–6 mm. long, puberulent; pappus-scales 9–11, lanceolate, subequal, 5–7 mm. long, exceeding the corolla-tube, acuminate, the hyaline margin erose or somewhat lacerate, the callose midrib dorsally pubescent.

Distribution: southern Georgia and Florida.

GEORGIA: without definite locality, *Baldwin* (ANSP), TYPE.

FLORIDA: Quincy, *Chapman* (ANSP); dry pine-barrens, near Apalachicola, Oct. 15, 1890, *ex Herb. Chapman 791a* (MBG); dry pine-barrens, Aspalaga, Oct. 1897, *ex Herb. Chapman 791b* (MBG); dry pine-barrens, near Jacksonville, Oct., *Curtiss 1507* (ANSP, MBG); near Jacksonville, Oct. 11, 1893, *Curtiss 4494* (MBG); pine-barrens, Indian River region, Brevard Co., Nov. 28, 1902, *Fredholm 5623* (MBG); Tampa, Oct. 1877, *Garber* (ANSP); in the vicinity of Eustis, June and July, 1894, *Hitchcock* (MBG); Miami, March, 1917, *Meredith* (ANSP); high pine-land, in the vicinity of Eustis, Lake Co., July 1-15, 1894, *Nash 1191* (MBG); dry pine woods, Polk Co., May 20, 1894, *Oblinger 349* (MBG); dry pine-lands, St. Leo, King Lake, Oct. 10, 1926, *O'Neill 1922* (MBG); Biscayne Bay, 1874, *Palmer* (MBG); Palatka, Dec. 5, 1871, *ex Herb. Porter* (ANSP); Miami, *Small & Carter* (ANSP); between Coconut Grove and Cutler, Dade Co., Nov. 1903, *Small & Carter 1231* (ANSP); Eustis, Oct. 8, 1896, *Webber 532* (MBG); St. Petersburg, Aug. 1894, *Williamson* (ANSP).

EXCLUDED SPECIES

Polypteris brasiliensis Less. in Linnaea 6:518. 1831 (= **Gaillardia lanceolata** Michx).

PALAFOXIA

Palafoxia Lag. Elench. Pl. Hort. Matr. 26. 1816, and Gen. et Sp. Nov. 26. 1816; Spreng. Syst. 3:449. 1826; DC. Prodr. 5:124. 1836, in part; Benth. & Hook. Gen. Pl. 2:405. 1873, in part; Gray, Geol. Surv. Calif. Bot. 1:387. 1876, in part, and in Proc. Am. Acad. Sci. 19:30. 1883; Baillon, Hist. des Plantes 8:249. 1886, in part; Gray, Syn. Fl. N. Am. 1^2:74, 338. 1884, and ed. 2, 1886; Hoffm. in Engl. & Prantl, Die Nat. Pflanzenfam. IV, Abt. 5, p. 261. 1891, in part; Small, Fl. Southeast. U. S. 1288. 1903, and ed. 2, 1913; Jepson, Man. Fl. Pl. Calif. 1127. 1925; Small, Man. Southeast. Fl. 1463. 1933; Munz, Man. South. Calif. Bot. 563. 1935.

Paleolaria Cass. in Bull. Soc. Phil. 198. 1816, and in Dict. Sci. Nat. 1, Suppl. 59. 1816, and 38:256. 1825.

Herbaceous, branching annuals, often becoming woody below and perennial. Stem usually one from a tap-root, strigose to hispid, eglandular to densely glandular-pubescent. Leaves alternate or the lower opposite, entire, thick, 1–3-nerved. Heads discoid, in cymose or corymbiform clusters terminating the branches. Involucre oblong or turbinate, the bracts in 2–3 series, subequal, entirely herbaceous, rarely membranaceous. Receptacle flat, naked, foveolate. Corollas regular, 5-lobed, the cylindraceous throat much longer than the corolla-lobes and short tube. Stamen-tube partly exserted from the throat, the anthers obtuse or rounded at the base. Style-branches filiform, spreading or recurved, hispidulous. Achenes quadrangular, linear to obpyramidal, pubescent. Pappus-scales several to 10, unequal, hyaline and scarious with a stout callose midrib, the scales of the marginal achenes often reduced.

Type species: **Palafoxia linearis** Lag. Elench. Pl. Hort. Matr. 26. 1816.

KEY TO THE SUBGENERA

A. Involucral bracts entirely herbaceous, green, somewhat keeled, closely enfolding the mature marginal achenes; pappus-scales longer than the corolla-tube ..... EUPALAFOXIA. Sp. 1

AA. Involucral bracts membranaceous, purplish, flat, not enfolding the outer achenes; pappus-scales shorter than the corolla-tube ..... PSEUDOPALAFOXIA. Sp. 2

KEY TO THE SPECIES AND VARIETIES

A. Involucral bracts herbaceous; pappus-scales longer than the corolla-tube.

B. Pappus-scales of the inner florets of the head acerose, equalling or exceeding the throat; plants erect.

C. Peduncles glandular-pubescent; leaves 2–6 mm. broad; florets about 15 in a head ..... 1. P. LINEARIS

CC. Peduncles almost eglandular; leaves 8–11 mm. broad; florets about 25 in a head ..... 1a. P. LINEARIS var. GIGANTEA

BB. Pappus-scales of the inner florets of the head obtuse or emarginate, shorter than the throat; plants somewhat decumbent ..... 1b. P. LINEARIS var. LEUCOPHYLLA

AA. Involucral bracts membranaceous; pappus-scales shorter than the corolla-tube ..... 2. P. FEAYI

1. **Palafoxia linearis** (Cav.) Lag. Elench. Pl. Hort. Matr. 26. 1816, and Gen. et. Sp. Nov. 26. 1816; Hook. in Curtis's Bot. Mag. **47**:*t. 2132*. 1820; Spreng. Syst. Veg. **3**:449. 1826; DC. Prodr. **5**:124. 1836; Dietrich, Syn. Pl. 1345. 1847; Gray, Geol. Surv. Calif. Bot. **1**:338. 1876, and Syn. Fl. N. Am. 1^2:338. 1884, and ed. 2, 1886; Rydb. in N. Am. Fl. 34^1:62. 1914; Jepson, Man. Fl. Pl. Calif. 1127, *fig. 992*. 1925; Tidestrom in Contrib. U. S. Nat. Herb. **25**:591. 1925; Munz, Man. South. Calif. Bot. 563. 1935.

Ageratum lineare Cav. Ic. **3**:3, *t. 205*. 1794.

Stevia linearis Cav. Praelect. n. 464, and Ic. **4**:32. 1797; Willd. Sp. Pl. 1774. 1804.

Stevia lavendulaefolia Schlecht. in Suppl. to Willd. Enum. Pl. 57. 1813; DC. Prodr. **5**:125. 1836, in synonymy.

Paleolaria carnea Cass. in Bull. Soc. Phil. 47. 1818, and in Dict. Sci. Nat. **38**:256. 1825; Less. Syn. Comp. 155. 1832.

An herbaceous annual, occasionally suffruticose and perennial; stem 1–7 dm. high, divaricately branched throughout, ascending, terete, furrowed, scabrous to roughly hispid, the upper parts glandular; leaves petiolate, linear to linear-lanceolate, 4–6 cm. long, 2–6 mm. wide, obtuse, entire, attenuated at the base, canescent-scabrous on both sides, thick, 1-nerved, often indistinctly 3-nerved, petioles 0.3–1.0 cm. long; peduncles long, slightly scabrous, densely glandular; heads in cymose or corymbiform clusters, 2–3 cm. high; involucre oblong to obconic, the bracts 7–13, linear-oblong, 1.0–1.5 cm. long, herbaceous throughout or those of the inner series with hyaline margins, acute to obtuse, scabrous, finely glandular, somewhat keeled, slightly saccate at the base, closely enfolding the marginal achenes; florets 10–18 in a head; corolla-lobes 1.5 mm. long, obtuse, the tips pubescent without; throat cylindraceous, about 5 mm. long, glabrous; tube slender, 2.5–3.5 mm. long, scarcely dilated at the base, glabrous to glandular-pubescent; achenes 1.0–1.5 cm. long, linear, attenuated downward; pappus-scales 3–8, unequal, the inner florets having either 4 long scales exceeding the throat, 0.7–1.0 cm. long, lanceolate, with a stiff, acerose midrib, alternating with 4 small, obtuse scales with included ribs, or 8 unequal scales, the marginal florets having 3–8 scales like those of the inner achenes or reduced to minute callosities with narrow, hyaline margins.

Distribution: Arizona to southern California.

ARIZONA: Yuma, *Beard 1911* (MBG); 20 mi. above Pierce's Ferry, April 19, 1894, *Jones 5081* (MBG); 11 mi. e. of Gila Bend, April 10, 1932, *Jones 29466* (MBG); sand desert on Ariz.-Nev. line, along U. S. Highway 91, Mohave-Clark Counties, April 4, 1934, *Maguire, Maguire & Maguire 5067* (MBG); in the Fortuna Range, Yuma, Feb. 26, 1930, *Nelson 11143a* (MBG); Williams Fork of the Colorado River, March 11, 1876, *Palmer 10253* (MBG).

NEVADA: sandy, stony washes, Virgin River, May 5, 1902, *Goodding 709* (MBG); desert 1 mi. w. of Riverside, Clark Co., May 19, 1933, *Maguire & Blood 4505* (MBG).

CALIFORNIA: old beach, Colorado Desert, San Diego Co., March 24, 1903, *Abrams 3147* (MBG); near Yaqui Wells, Colorado Desert, San Diego Co., April 12, 1913, *East-*

wood 2676 (MBG); White Water Desert, Nov. 11, 1890, *Engelmann* (MBG); Palm Springs, March, 1927, *Epling* (MBG); alluvial fan, Opher mine, Mohave Desert, Slate Mts., April 18, 1930, *Epling, Ellison & Anderson* (MBG); sand flat, Thousand Palms Canyon, Coachella Valley, Riverside Co., March 13, 1932, *Fosberg 8093* (MBG); wash, w. end of Sheep Hole Mts., San Bernardino Co., April 24, 1932, *Fosberg 8172* (MBG); western borders of the Colorado Desert, Coyote Canyon, Lower Sonoran Zone, April, 1902, *Hall 2768* (MBG); Palm Springs, Apr. 1926, *Haupt* (MBG); sandy wash, Deep Canyon, Coachella Valley, Riverside Co., March 14, 1932, *Munz 11975* (MBG); sandy wash, 5 mi. n. w. of Dixieland, Imperial Co., April 4, 1932, *Munz & Hitchcock 12109* (MBG); Indian Springs, Colorado Desert, June 24, 1888, *Orcutt 1500* (MBG); s. w. part of the Colorado Desert, San Diego Co., Nov. 1889, *Orcutt* (MBG); Carris Creek, Colorado Desert, April 25, 1890, *ex Orcutt Herb. 2241* (MBG); Indio, Colorado Desert, April 24, 1891, *ex Orcutt Herb.* (MBG); Whitewater, Riverside Co., March, 1882, *Parish 4*, and June 14, 1894, *3109* (MBG); Palm Springs, desert base of San Jacinto Mt., April 4-13, 1896, *Parish 4121* (MBG); desert wash, 15 mi. w. of Indio, L. A. Aqueduct Rd., Colorado Desert, Riverside Co., Jan. 1, 1936, *Rose 36003* (MBG).

1a. Palafoxia linearis var. **gigantea** Jones, Extracts from Contrib. West. Bot. **18**:79. 1933; Munz, Man. South. Calif. Bot. 563, *fig. 299*. 1935.

Palafoxia linearis var. *arenicola* Nelson in Am. Jour. Bot. **23**:265. 1936.

Stem erect, annual or perennial, 7–10 dm. high, glabrous or nearly so; leaves 6–8 cm. long, 8–11 mm. broad, distinctly 3-nerved; peduncles strigose and almost eglandular; heads large, 2.5–3.0 cm. high; involucral bracts about 24, strigose, eglandular; florets 25 or more; achenes about 1.5 cm. long; pappus-scales 8, unequal, 0.5–1.0 cm. long, the four long, acerose scales equalling or exceeding the throat, the four alternate scales very short, usually obtuse, with included midrib; in other characters as the species.

Distribution: California, in sand dunes west of Yuma, Arizona.

CALIFORNIA: w. of Yuma, Ariz., Sept. 24, *Jones 28599* TYPE, and Feb. 27, 1930, *Nelson 11161* (MBG); common in dunes e. of Holtville, Imperial Co., April 5, 1932, *Munz & Hitchcock 12131* (MBG).

1b. Palafoxia linearis var. **leucophylla** Johnston in Proc. Calif. Acad. Sci. IV. **12**:1202. 1924

P. leucophylla Gray in Proc. Am. Acad. **8**:291. 1870, and Geol. Surv. Calif. Bot. **1**:388. 1876; Rydb. in N. Am. Fl. **34**[1]:63. 1914.

P. linearis Gray in Proc. Am. Acad. **19**:31. 1883, not Lag. Gen. et Sp. Nov. 26. 1816.

P. arenaria Brandeg. in Proc. Calif. Acad. Sci. II. **2**:178. 1889; Goldman in Contrib. U. S. Nat. Herb. **16**:369. 1916.

A shrubby, somewhat decumbent, much-branched perennial; stem 4–10 dm. high, densely glandular-hispid and scabrous in the upper parts or throughout; heads 1.5–2.0 cm. long; pappus-scales about 8, unequal, not exceeding the throat, often no more than half the length of the throat, obtuse or emarginate, sometimes acute; in other characters as the species.

Distribution: Mexico, chiefly Baja California.

MEXICO:
COAHUILA: Torreon, Oct. 13-20, 1898, *Palmer 486* (MBG).
BAJA CALIFORNIA: sand dunes, San Nicholas Bay, May 16, 1921, *Johnston 3716* (MBG); sand dunes, Loreto, May 20, 1921, *Johnston 3776* (MBG); La Paz, Feb. 7, 1928, *Jones 24065* (MBG).

2. **Palafoxia Feayi** Gray in Proc. Am. Acad. **12**:59. 1877; Chapman in Bot. Gaz. 3:6. 1878; Gray, Syn. Fl. N. Am. 1^2:338. 1884, and ed. 2, 1886; Chapman, Fl. South. U. S., ed. 3, 261. 1897; Small, Fl. Southeast. U. S. 1288. 1903, and ed. 2, 1913; Rydb. in N. Am. Fl. 34^1:63. 1914; Small, Man. Southeast. Fl. 1463. 1933.

An herbaceous perennial, woody at the base; stem 4–10 dm. high, simple or branched, erect, terete, strigillose, furrowed; leaves petiolate, lanceolate-oblong to oblong-elliptic, 2.5–5.5 cm. long, 0.5–2.5 cm. broad, usually obtuse, slightly callose at the tip, rounded at the base, rather scabrous, the hair-bases often white and conspicuous, distinctly 3-nerved, petioles 2–6 mm. long; peduncles long and slender, strigillose, eglandular; heads numerous, in corymbiform clusters, 1.5–2.0 cm. high; involucre turbinate, the bracts 9–11, linear to oblong, 5–8 mm. long, membranaceous, thickened along the midvein, truncate or obtuse, often strigillose, purple-tipped or purplish throughout, several of the outer series shorter and reflexed, 2–4 mm. long; florets about 18 in a head; corolla-lobes 1.5–2.5 mm. long, obtuse, the tips thickened and pubescent without; throat cylindraceous, 4–5 mm. long, glabrous; achenes 6–8 mm. long, obpyramidal, sparingly pubescent; pappus-scales 8–10, usually obovate, subequal, 0.5–3.0 mm. long, obtuse, the scarious margin erose, the midrib dorsally pubescent and extending about two-thirds the length of the scale.

This species is intermediate between the genera *Polypteris* and *Palafoxia*, but it is placed in the latter group because of the floret characters. The nature of the involucre and the general habit of the plant, however, suggest a close alliance with *Polypteris*.

Distribution: Florida.

FLORIDA: Clear Water Harbor to Caxambas, *Chapman* (G); without definite locality, *Curtiss 102* (G); sandy soil, Indian River, Sept., *Curtiss 1507* (G); dry scrub near Seville, Volusia Co., July 17, 1900, *Curtiss 6688* (G, MBG); s. Florida, comm., Jan. 7, 1876, *Feay* (G), TYPE; dry pine-barrens, Indian River region, Brevard Co., Oct. 29, 1902, *Fredholm 5528a* (G); Caxambas Bay, Sept. 1878, *Garber 11870* (MBG); flat woods, Marco, Lee Co., July & Aug., 1900, *Hitchcock 139* (G, MBG); scrub land, Wekiwe Springs, Sept. 16, 1929, *O'Neill 5601* (MBG); dry, sandy soil, open scrub land, Kelsey City, Palm Beach Co., Nov. 25, 1920, *Randolph 157* (G); without definite locality, 1842-1849, *Rugel 60* (MBG); pine-lands about Arch Creek Prairie, Dade Co., July 3, 1915, *Small, Mosier & Small 6811* (G); Manatee, Sept. 12, 1899, *Tracy 6357* (MBG); Palma Sola, April 30, 1900, *Tracy 6932* (MBG).

LIST OF EXSICCATAE

The distribution numbers are indicated by *italics*, or, when the specimen is not numbered, by a dash. The numbers in parenthesis refer to the species in this study.

OTHAKE

Ammerman, Elizabeth. *7* (2); *8*, *39* (1); *97* (3).
Baker, Carl F. — (6).
Barkley, Fred A. *1499* (3).
Berlandier, Jean. *604*, *2041* (3).
Bremer, E. — (6).
Bush, Benjamin F. *115*, *204*, *476*, *1146* (1); *1599* (2); *3187*, *3354*, *4983*, *14999*, *15180*, *15195*, *15752*, *15756*, *15942* (1).
Carleton, M. A. — (6).
Clemens, Mrs. Joseph. — (6).
Cory, V. L. *25366* (1); *26155* (3).
Cutak, Ladislaus. — (6).
Duncan, Mrs. F. T. *29* (6).
Earle, F. S. & E. S. Earle. *381* (6).
Eggert, Henry. — (1); — (2); — (6).
Eggleston, W. W. *16193* (6).
Emig, W. H. *43* (1).
Eskew, C. T. *1502* (1); *1524* (6).
Ferris, Roxana S. & Carl D. Duncan. *2915* (1); *3014* (3); *3365* (6); *3375* (3); *3411*, *3501* (6).
Galeotti, H. *2627* (4).
Glatfelter, N. M. — (2).
Goodman, George Jones. *2175*, *2354* (6).
Greenman, Jesse More. *95* (4).
Griffiths, David. *6320* (3).
Hall, Elihu. *356* (1).
Hapeman, H. — (6).
Heller, A. Arthur. *1562* (2a).
Hitchcock, Albert S. *288* (6).
James, E. P. — (6).
ex Jermy Herb. *804* (1).
Jones, Marcus E. *26398*, *29467* (3).
Joor, J. F. — (2); — (5); — (7).
Kenoyer, Leslie A. — (3); *728* (2a).
Letterman, George W. — (1); — (6).
Linden, Jean-Jules. — (4).
Lindheimer, Ferdinand. — (2); — (7); *955*, *956* (1).
Mackenzie, Kenneth K. — (1); *7* (3).
Nelson, Aven. *11680* (6).
Nuttall, Thomas. — (1).
Orcutt, Charles Russell. *5548* (3).
Osterhout, George E. *4097*, *4314* (3a).
Ownbey, Francis Marion. *1051* (3a).
Palmer, Ernest J. *38* (2a); *4078*, *4492*, *4633*, *4893*, *6443a* (1); *8575*, *10732* (2); *10782* (3); *10898* (1); *12543* (6); *12856* (1); *14100* (6); *19067*, *29531* (1); *31756* (5); *33012* (1); *41895* (6).
Pammel, L. H. — (2).
Parks, H. B. — (1); — (2a); — (7).
Parks, H. B. & E. Ammerman. *62* (3).
Parks, H. B., E. Bremer & E. Ammerman. — (7).
Parks, H. B. & V. L. Cory. —, *12290*, *12401* (3); *16941*, *16942* (2a); *16946* (3); *20747*, *20748* (1).
Pringle, Cyrus Guernsey. *2655* (3); *6354* (2a).
Purpus, C. A. *6025* (4).
Reverchon, Jules. — (1); *1230* (2a); *2577* (2); *3219* (6); *3288* (1); *3289* (5); *3290* (2); *3655* (1); *3656* (2).
Runyon, Robert. *209* (2a).
Shepard, E. M. — (1).
Smyth, H. B. *783* (6).
Stevens, G. W. *2908* (6).
Steyermark, Julian A. *14657* (1).
Stratton, Robert A. *411* (6).
Thompson, Charles H. *76* (6).
Tracy, S. M. *8142* (1); *8163* (6).
Trelease, William. — (2); *66* (3).
Warner, Selden R. — (2).
White, Mark. *250* (6).
White, Paul. — (6).
Wislizenus, Frederick W. — (1).
Wooton, E. O. —, *28* (6).
Wynd, F. Lyle & C. H. Mueller. *83*, *120* (3).

POLYPTERIS

Baldwyn. — (1).
Chapman, A. W. — (1).
ex Chapman Herb. *791a*, *791b* (1).
Curtiss, A. H. *1507*, *4494* (1).
Fredholm, A. *5623* (1).
Garber, A. P. — (1).
Hitchcock, Albert S. — (1).
Meredith, D. W. — (1).
Nash, George Valentine. *1191* (1).
Ohlinger, L. B. *340* (1).
O'Neill, Hugh. *1922* (1).
Palmer, Edward J. — (1).
ex Porter Herb. — (1).
Small, John Kunkel & J. J. Carter. —, *1231* (1).
Webber, H. J. *532* (1).
Williamson, C. S. — (1).

PALAFOXIA

Abrams, LeRoy. *3147* (1).
Beard, A. *1911* (1).
Chapman, A. W. — (2).
Curtiss, A. H. *102*, *1507*, *6688* (2).
Eastwood, Alice. *2676* (1).
Engelmann, George. — (1).
Epling, Carl C. — (1).

Epling, Carl, Lincoln Ellison, & Harvey Anderson. — (1).
Feay, W. (2).
Fosberg, F. R. *8093*, *8172* (1).
Fredholm, A. *5528a* (2).
Garber, A. P. *11870* (2).
Goodding, Leslie N. *709* (1).
Hall, H. M. *2768* (1).
Haupt, A. W. — (1).
Hitchcock, Albert S. —, *139* (2).
Johnston, Ivan M. *3716*, *3776* (1b).
Jones, Marcus E. *5081* (1); *24065* (1b), *28599* (1a); *29466* (1).
Maguire, Bassett & H. L. Blood. *4505* (1).
Maguire, Bassett, Ruth Maguire, & C. B. Maguire. *5067* (1).
Munz, Philip A. *11975* (1).
Munz, Philip A. & Charles Leo Hitchcock. *12109* (1); *12131* (1a).
Nelson, Aven. *11143a* (1); *11161* (1a).
O'Neill, Hugh. *5601* (2).
Orcutt, Charles Russell. —, *1500* (1).
ex Orcutt Herb. —, *2241* (1).
Palmer, Ernest J. *468* (1b); *10253* (1).
Parish, Samuel B. *4*, *3109*, *4121* (1).
Randolph, Fannie R. *157* (2).
Rose, Lewis S. *36003* (1).
Rugel, F. *60* (2).
Small, John Kunkel, S. A. Mosier, & Gertrude K. Small. *6811* (2).
Tracy, S. M. *6357*, *6932* (2).

INDEX TO GENERA AND SPECIES

Valid recognized names are in Roman type; synonyms in *italics*; and new names in **bold face** type.

EXPLANATION OF PLATE

PLATE 10

Othake callosum

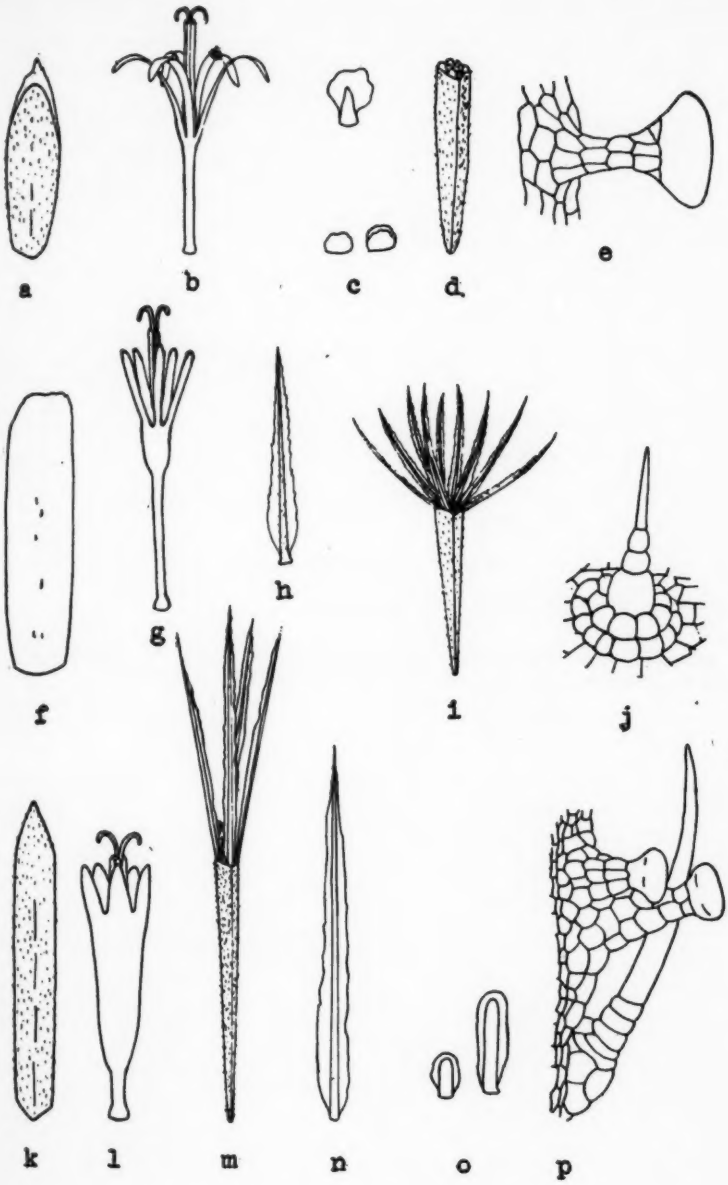
a. involucral bract (x 5.7)
b. corolla (x 5.7)
c. pappus-scales (x 5.7)
d. achene (x 9.5)
e. glandular hair on peduncle, greatly magnified

Polypteris integrifolia

f. involucral bract (x 4.75)
g. corolla (x 2.8)
h. pappus-scale (x 5.7)
i. achene (x 4.75)
j. tuberculate hair on leaf, greatly magnified

Palafoxia linearis

k. involucral bract (x 4.75)
l. corolla (x 5.7)
m. achene (x 3.8)
n. pappus-scale (x 5.7)
o. pappus-scales of marginal achenes (x 7.6)
p. hairs on peduncle, greatly magnified

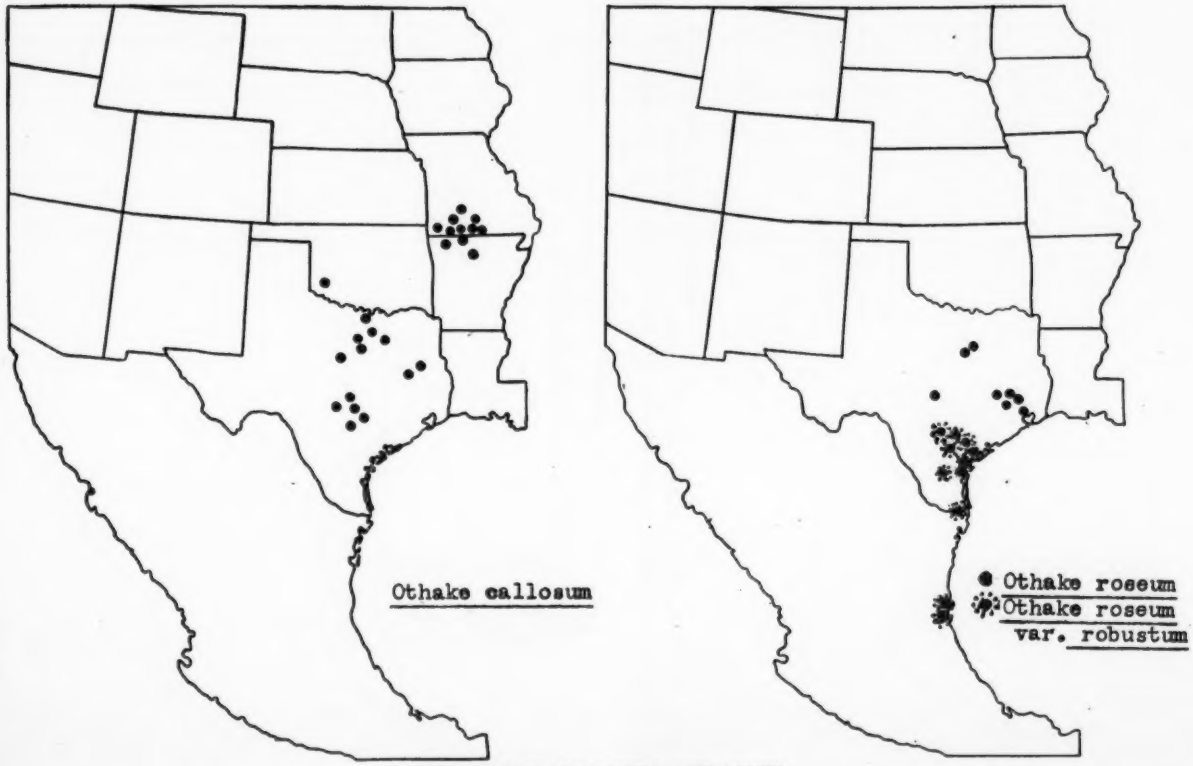


AMMERMAN—PALAFOXIA AND ALLIES

EXPLANATION OF PLATE

PLATE 11

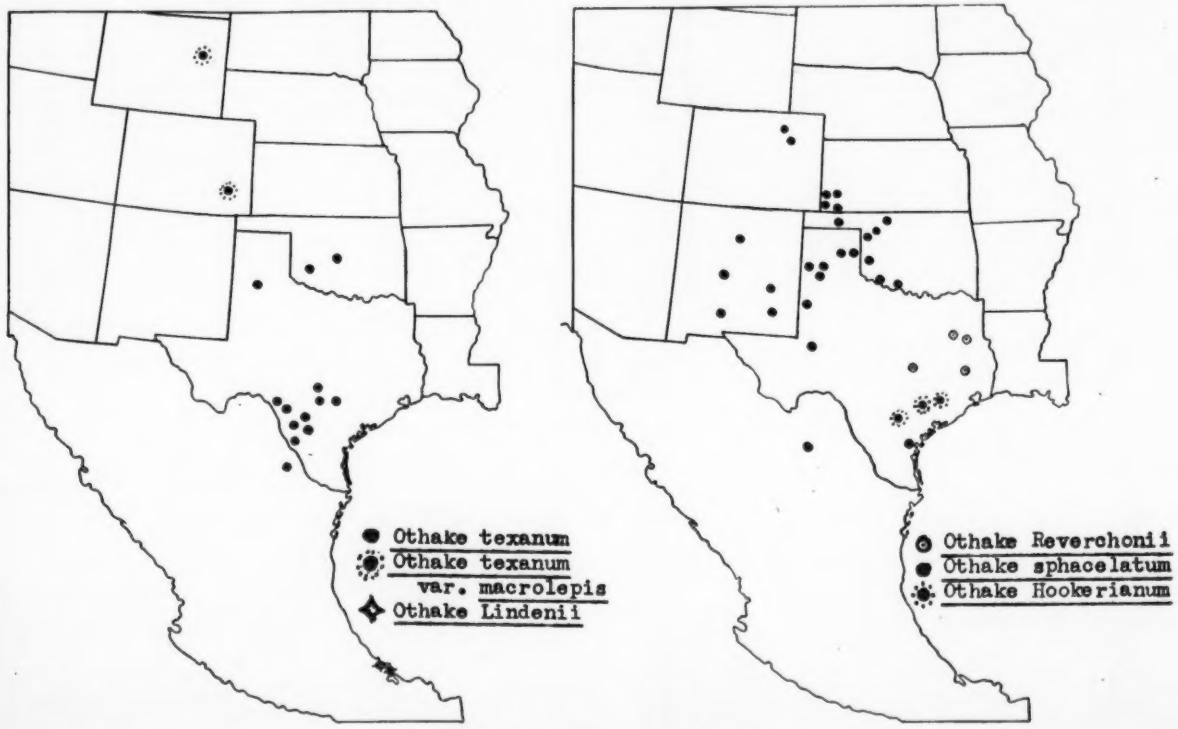
Distribution of *Othake callosum*, *O. roseum*, and *O. roseum* var. *robustum* as indicated by specimens in the Herbarium of the Missouri Botanical Garden.


Othake callosum
Othake roseum
Othake roseum var. robustum

Explanation of Plate

PLATE 12

Distribution of *Othake texanum*, *O. texanum* var. *macrolepis*, *O. Lindenii*, *O. Reverchonii*, *O. sphacelatum*, and *O. Hookerianum*, as indicated by specimens in the Herbarium of the Missouri Botanical Garden.

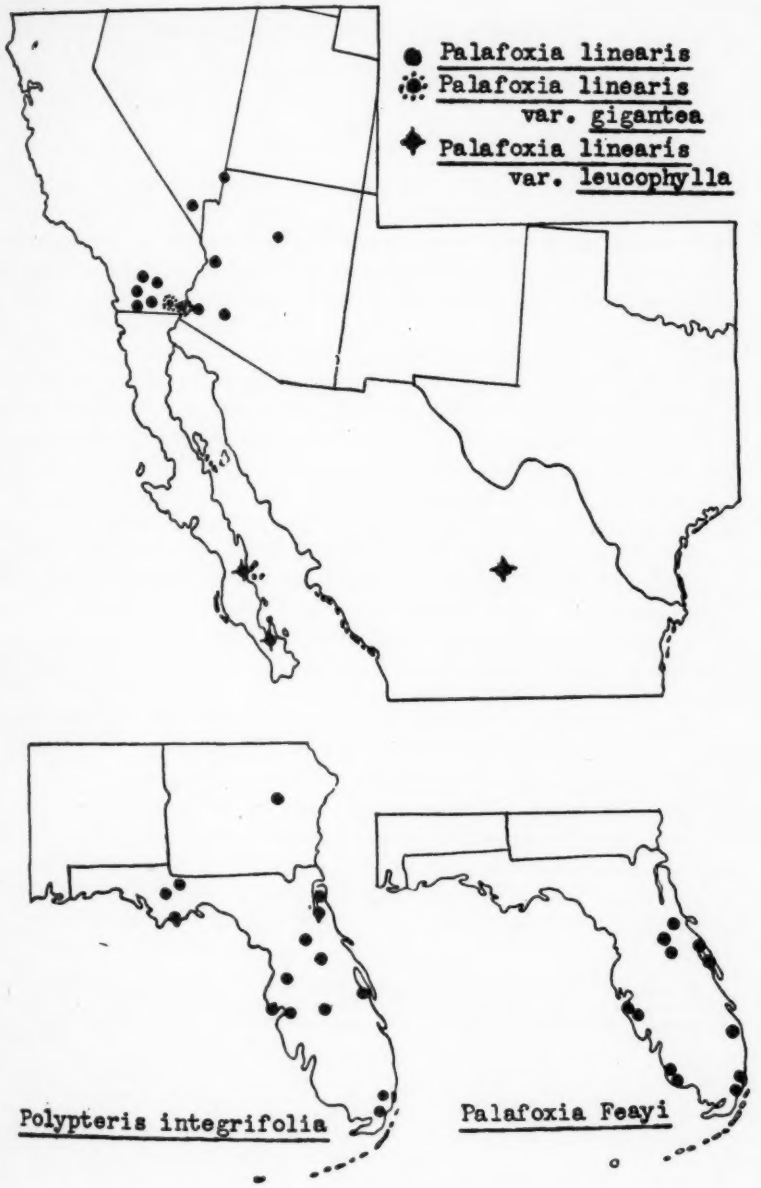


ANN. MO. BOT. GARD., VOL. 31, 1944

EXPLANATION OF PLATE

PLATE 13

Distribution of *Palafoxia linearis*, *P. linearis* var. *gigantea*, *P. linearis* var. *leucophylla*, *Polypteris integrifolia*, and *Palafoxia Feayi*, as indicated by specimens in the Herbarium of the Missouri Botanical Garden.



AMMERMAN—PALAFOXIA AND ALLIES

MONOGRAPH OF PSILOSTROPHE[1]

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INTRODUCTION AND HISTORY

In this paper there has been an attempt to clarify the confusion in the taxonomy of the genus *Psilostrophe*. It has necessitated a critical study of the morphology and of the geographical distribution of the several entities which comprise this interesting composite of southwestern North America. No novelties have been added in this treatment; rather it consists of a reduction in the number of species hitherto recognized.

Psilostrophe received its name from de Candolle[2] in the year 1838; the genus was based on specimens collected by Berlandier at San Luis Potosi, Mexico. Three years later Nuttall[3] described a new genus, *Riddellia*, from a specimen collected by James on Long's Expedition, but no definite locality was recorded.[4] *Riddellia* subsequently proved to be synonymous with *Psilostrophe*, but the name was used for the next half century before it lapsed into synonymy. Gray, who did much work on the genus, realized that his *Riddellia arachnoidea* was the same as de Candolle's *Psilostrophe gnaphalodes*.[5] However, he later wrote:[6] *Psilostrophe*, "a name which although a year or two earlier in publication [than *Riddellia*] we trust may remain disused, having been accompanied by an insufficient, and, in some important respects, erroneous character." Nevertheless, according to the International Rules of Botanical Nomenclature, the older name, *Psilostrophe*, should be used, although the genus may have been incorrectly described in some minor details. In 1891 it was restored as the valid generic name by Greene.[7]

Gray[8] in his 'Synoptical Flora of North America' recognized three species and one variety of *Psilostrophe*. In the only paper approaching a monographic study of the genus,[9] A. Nelson in 1903 included six species and two varieties, but this treatment is inadequate to meet present needs. Since that time the most important treatment of the genus is Rydberg's,[10] where three new species are described, bringing the total number of species to ten, some of which are reduced in this monograph. Type material, or duplicates of types, of most of the species has been examined in this study.

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[1] An investigation carried out in the graduate laboratory of the Henry Shaw School of Botany of Washington University, and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University.
[2] de Candolle, A. Prodr. 7:261. 1838.
[3] Nuttall in Trans. Am. Phil. Soc. II. 7:371. 1841.
[4] Gray in Mem. Am. Acad. II. 4:94. 1849
[5] Gray in Smithson Contr. to Knowl. 3:121. 1852.
[6] Gray in Proc. Am. Acad. 7:358. 1868.
[7] Greene, Pittonia 2:176. 1891.
[8] Gray, Syn. Fl. N. Am. 1[2]:317. 1884, and ed. 2, 1886.
[9] Nelson in Proc. Biol. Soc. Wash. 16:21. 1903.
[10] Rydberg in Britton, N. Am. Fl. 34:6. 1914.

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Morphology

All the species of *Psilostrophe* arise from a ligneous tap root. The stems are generally somewhat striate, from almost glabrous in *P. sparsiflora* through all degrees of villosity to densely pannose in *P. Cooperi.* Gray [11] correctly describes the pubescence of the stem of *P. Cooperi* as "canescent with close and matted tomentum." The base of the plant, which is usually woody, is frequently more densely hairy than the upper part of the stem. The color of the stem varies, depending on the amount of pubescence, from green in *P. sparsiflora* and occasionally in *P. tagetina,* to gray, and white in *P. Cooperi.* A slight twisting of the stem may show up somewhat in *P. tagetina* var. *lanata* and is frequently very marked in *P. sparsiflora.*

The lower leaves vary in size up to 15 cm. in length and are usually less than half as broad. All measurements in this paper are from dried specimens. As a general rule, the leaves are less villous than the stems and involucres. In shape, there is a wide degree of variation from obovate to linear. Some of the leaves may be lobed in all of the species except in *P. Cooperi.* The lower leaves are quite frequently lacking on the herbarium specimens.

The upper leaves are alternate, generally entire, sessile, and smaller than the basal leaves. They are also usually less villous than the lower leaves and consequently greener. In shape, they vary from spatulate to linear. The leaves fail to offer much of taxonomic value in delimiting the species.

The involucre is cylindrical to campanulate and composed of one definite series of 4–12 linear-oblong or lanceolate connivent bracts, but which often appear connate because of the dense pubescence. There is an inner indefinite series of 1–7 smaller scarious bracts, and sometimes an outer calyculate bract is present.

The heads are on long peduncles up to 8.0 cm. in length in *P. Cooperi;* or they may be clustered on shorter peduncles; or almost sessile as in *P. gnaphalodes.* The length of the peduncles is of some taxonomic worth in distinguishing *P. gnaphalodes* and *P. villosa* from *P. tagetina,* but this character by itself is of doubtful value because of intergradations.

The ligules, which are always some shade of yellow, become papery in age and persist on the achenes. There is great variation in the length of the ligules even among the same species. Nevertheless, the size often serves as a diagnostic character, for in *P. Bakeri* and *P. Cooperi* the ligules are from 8 to 14 or 16 mm. long, while in *P. villosa* they are only 3 to 5 mm. long. There is also a variation in the number of ligules present, 3–4 in most species, but from 4 to 8 in *P. Bakeri* and *P. Cooperi.* The ligules are 4–7-nerved, and the nerves unite in pairs within the lobes. Most of the species have shallowly 3-lobed ligules, rarely 4–5-lobed, but in *P. villosa* the lobes may extend half the length of the ligule. In some plants there may be found ligules with 3, 4, and 5 lobes on the same plant. The ligules, which are broader than long, are contracted at their base into a tube

[11] Gray, Syn. Fl. N. Am. 1[2]:318. 1884, and ed. 2, 1886.

from which the style protrudes. The style-branches of the ray-flowers are elongated, subterete, and more or less acute at the apex.

The number of disk-flowers varies from as few as 5 to as many as 20, the larger number being found in *P. Cooperi* and *P. Bakeri*. The anthers are obtuse at the base, lanceolate, and acute at the tips, and the style branches are truncate-capitellate at the apex in contrast to those of the ray-flowers.

The achenes are small, 1.5–5 mm. long, narrow, terete or obtusely angled, and striate when dried. They are glabrous or provided with only a few short hairs, except in *P. gnaphalodes*, where they are long-villous. The hairs in this species project upward and usually exceed the achene in length. This feature is the only good single character separating *P. gnaphalodes* from *P. villosa* and *P. tagetina* in the areas where their distribution overlaps.

The pappus is made up of 6, occasionally 4 or 5, hyaline scales or squamellae. The squamellae may be entire or denticulate, obtuse or acute, unequal or equal in length, lanceolate to ovate in shape, and from less than one half to more than one half the length of the disk-flowers. In *P. tagetina* the pappus may range from one extreme to the other, and some of the scales may be obtuse while others in the same head may be acutish. In some of the species, such as *P. villosa*, *P. Bakeri*, and *P. gnaphalodes*, the pappus is fairly uniform. By itself it is a very unreliable taxonomic guide in this genus.

Other morphological features that should receive mention are the glands and the pubescence. All parts of the plant are frequently glandular-dotted. The stem of *P. sparsiflora*, which is much less villous than the stems of the other species, is quite often glandular. The tube of the disk-flowers may be dotted with these glands, and in some plants the glands extend onto the achene, and rarely they may be present on the pappus-scales. The ligules show the presence of these glands, particularly on the lower surface, and the leaves may show them in some number.

The pubescence, best described as woolly in most cases, is made up of long, multicellular hairs which frequently terminate in a small gland. The hairs of the achenes of *P. gnaphalodes* are very similar to those of other parts of the plant, but rarely terminate in a gland and are more frequently unicellular. The hairs on the squamellae of this species arise directly from the pappus-scales. The squamellae of other species are composed of elongated cells, the terminal ones ending more or less together, whereas in *P. gnaphalodes* some of the terminal cells give rise to hairs which extend beyond the scale. The pubescence of the stem and leaves tends to disappear with age.

Discussion of Problems and Relationships of Species

In this study it was seen at once that *P. Cooperi* and *P. Bakeri* could be readily segregated from the other species. Even macroscopically they are seldom to be mistaken for any other species, many of which were labeled either *P. tagetina* or *P. gnaphalodes*. By separating the almost glabrous plants from these, with a

few exceptions, *P. sparsiflora* became evident. The distribution of this species in northern Arizona and southern Utah was of great help.

P. villosa is clear-cut in its northern range, but in Texas it is often difficult to distinguish from *P. tagetina* and *P. gnaphalodes*. However, on the basis of glabrous or villous achenes the plants which appeared alike to the naked eye could be placed in either *P. villosa* or *P. gnaphalodes*.

Those plants which did not fall into the above two species were placed in the "tagetina complex." The diversity of these plants in detailed character is not paralleled in other members of the genus. Nelson[12] noted this and commented, "the difference seems to be vegetative and not congenital." There seems to be no consistent basis for segregating this heterogeneous group except into the two varieties, *P. tagetina* var. *lanata* and *P. tagetina* var. *grandiflora*. Perhaps some future worker will see fit to split the "tagetina complex" into several species, but the writer believes that *P. tagetina* should be treated as a comprehensive specific unit.

The possibility of hybridization is strongly suggested, and on the basis of morphology and geography the following hybrids are conceivable:

P. tagetina x gnaphalodes
P. tagetina x villosa
P. villosa x gnaphalodes
P. tagetina x sparsiflora

Cytological studies might go a long way in throwing light on some of the problems of specific relationships. No chromosome counts for any species of this genus have been published, so far as the author is aware, and as he was unable to obtain living specimens he could not supply the information.

It is interesting but rather dangerous treading to try to draw conclusions regarding the phylogeny of *Psilostrophe* and its species. The most interesting speculation is in regard to the age of *P. gnaphalodes* as compared with the other species. If *P. gnaphalodes* is thought of as derived from one of the other species then we may claim to see the actual development of a hair-like pappus from a scale-like one. If, on the other hand, *P. gnaphalodes* is thought of as the archetype we might then use the evidence to show the development of a scale-like pappus from a hairy one. The writer is in sympathy with the former hypothesis, for it is his belief that the progenitor was a species that is now relatively constant in morphological features, a perennial rather than a biennial, and does not tend to hybridize.

The presence of close generic relatives helps very little in this problem, for the nearest genus is *Baileya*, in which a pappus is lacking.

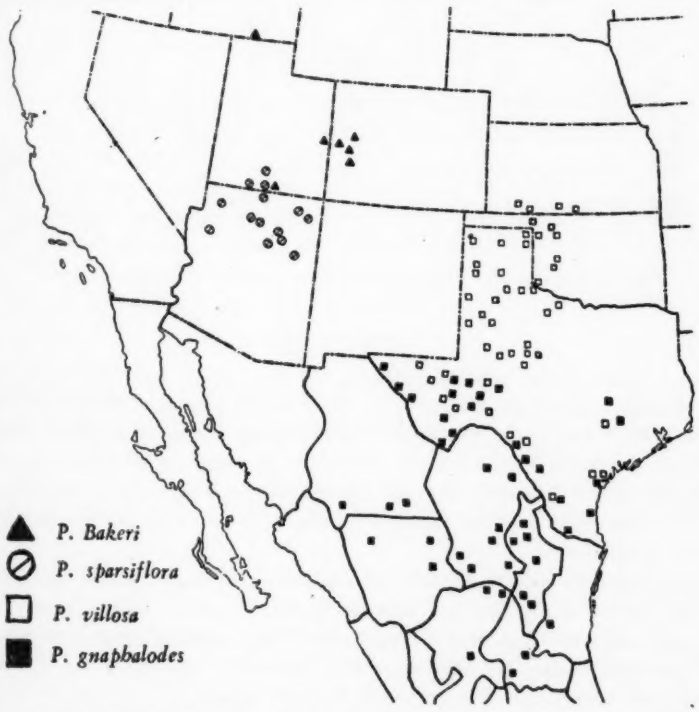
Psilostrophe has been placed in the subtribe Riddellieae of the tribe Helenioideae by Gray[13] and later botanists.[14] The other two genera of the subtribe Riddellieae

[12] Nelson in Proc. Biol. Soc. Wash. 16:21. 1903.
[13] Gray, Syn. Fl. N. Am. 1[2]:71. 1884, and ed. 2, 1886.
[14] Tribe Heleniese, subtribe Riddellinae. Engler & Prantl, Nat. Pflanzenfam. 4:253. 1890. Tribe Helenieae, subtribe Riddellianae. Rydberg in Britton, N. Am. Fl. 34:6. 1914.

are *Baileya* and *Whitneya*. The latter, a monotypic genus from California, is very distinct from the other two genera because of its opposite leaves, sterile disk-flowers, and absence of pappus. *Baileya*, on the other hand, is very closely allied to *Psilostrophe;* the principal taxonomic distinctions between the two are that *Baileya* lacks a pappus, usually has a greater number of ray and disk-flowers, and has bracts arranged in two more definite series.

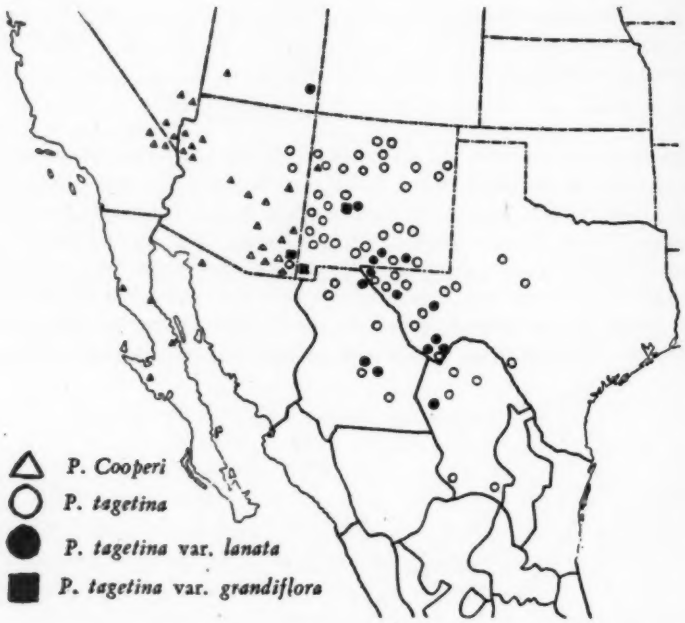
Geographical Distribution

Psilostrophe is confined to southwestern North America, extending from southern Idaho in the north to San Luis Potosi in the south, from Texas in the east to San Bernardino County, California, in the west. The plants are found in ten of the United States and nine Mexican states. The greatest specific concentrations are in western Arizona and western Texas where three species each are found. *P. tagetina* and *P. gnaphalodes* have the widest known distribution of any of the species, while *P. sparsiflora* and *P. Bakeri* have the most restricted distribution. The plants are more or less xerophytic, preferring high, dry, sandy



Map 1. Showing distribution of *Psilostrophe Bakeri*, *P. sparsiflora*, *P. villosa* and *P. gnaphalodes*.

soil as a rule. Maps 1–2 show the distribution of the species and varieties of *Psilostrophe*.



Map 2. Showing distribution of *Psilostrophe Cooperi* and *P. tagetina* and its varieties.

Economic Uses

The economic uses of *Psilostrophe*, as in the case of many Compositae, are very limited. Their chief value is probably as ornamentals. Parks[15] says that *P. gnaphalodes* and *P. tagetina* make excellent border plants. However, *P. gnaphalodes* is poisonous to live stock. Further, he recommends that these two species be grown by nurserymen and made available to gardeners. Gray[16], soon after the genus was described, pointed out that *P. tagetina* should "be very ornamental in cultivation."

P. gnaphalodes and *P. tagetina* are both very attractive plants, particularly var. *grandiflora* of *tagetina*, but both are excelled in beauty by *P. Cooperi*. This tall plant with its large papery rays makes a very striking appearance even on the herbarium sheet. In addition to this species, *P. sparsiflora* and *P. Bakeri* should make exceedingly fine perennials for cultivation.

[15] Parks in Tex. Agr. Exp. Sta. Bull. No. 551, p. 160. 1937.
[16] Gray in Mem. Am. Acad. II. 4:93. 1849.

Common Names

"Paperflower" is the most common name for this genus. Common names of the various species according to Kelsey and Dayton[17] are as follows: "white-stem paperflower" for *Psilostrophe Cooperi*, "cudweed paperflower" for *P. gnaphalodes*, "greenstem paperflower" for *P. sparsiflora*, and "woolly paperflower" for *P. tagetina*. The last name, of course, could equally well apply to several of the species.

Acknowledgments

The author wishes to express his thanks to Dr. J. M. Greenman, who suggested and guided this study, and to Dr. George T. Moore, Director, for the facilities of the library and herbarium of the Missouri Botanical Garden placed at his disposal. Acknowledgments are also due the librarians and members of the staff of the Missouri Botanical Garden for their cooperation and interest, and to the other institutions and herbaria which have made this work possible through the loan of herbarium specimens.

Abbreviations

The herbaria cited in this paper are indicated by the following abbreviations:

FM—Chicago Museum of Natural History, formerly Field Museum of Natural History.
G—Gray Herbarium of Harvard University.
MBG—Missouri Botanical Garden.
PA—Philadelphia Academy of Natural Sciences.
T—University of Texas.
US—United States National Herbarium.

Taxonomy

Psilostrophe DC. Prodr. **7**:261. 1838; Greene, Pittonia **2**:176. 1891; Britt. & Brown, Ill. Fl. **3**:444. 1898, and ed. 2, **3**:504. 1913; Britt. Man. 1005. 1901; Greene, Pl. Baker. **3**:29. 1901; A. Nels. in Proc. Biol. Soc. Wash. **16**:21. 1903; Small, Fl. Southeastern U. S., ed. 2, 1372. 1913; Rydb. in Britt. N. Am. Fl. **34**:6. 1914; Jepson, Man. Fl. Pl. Calif. 1133. 1925; Rydb. Fl. Prair. and Plains, 852. 1932.

Riddellia Nutt. in Trans. Am. Phil. Soc. II. **7**:371. 1841; Torr. & Gray, Fl. N. Am. **2**:362. 1842; Gray in Mem. Am. Acad. II. **4**:93. 1849; Gray in Proc. Am. Acad. **7**:358. 1868; Benth. & Hook. Gen. Pl. **2**:401. 1873; Gray, Syn. Fl. N. Am. 1^2:71, 317. 1884, and ed. 2. 1886; Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. **4**:253. 1890.

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[17] Kelsey & Dayton, Standardized Plant Names, p. 504. 1942.

DESCRIPTION OF THE GENUS

Perennial, rarely biennial, herbs or low shrubs, growing in clumps, from a tap root, 5 to 60 cm. in height; stem branching, pannose, densely villous, or glabrate. Lower leaves petioled, obovate to oblanceolate, entire or occasionally lobed, villous to glabrate, upper leaves alternate, smaller and sessile, spatulate to linear, rarely lobed. Involucre of 4–12 linear-oblong to lanceolate, villous, connivent bracts, and an inner series of 1–7 smaller scarious bracts, rarely an outer calyculate one. Receptacle naked. Inflorescence corymbose. Heads long-peduncled to subsessile. Ray-flowers pistillate, fertile, in a single series of 3–7. Ligules yellow, papery and persistent on the achenes, 3–16 mm. long, slightly 3–5-lobed. Disk-flowers hermaphrodite, fertile, regular. Corolla-tube with cylindric throat and 5 glandular lobes. Anthers obtuse at the base and acute at the apex. Style-branches of the ray-flowers capillary, of disk-flowers truncate at the tips. Achenes small, linear, more or less striate, obtusely angled or terete, glabrous or essentially so, or long-villous. Pappus of 4–6 nerveless hyaline squamellae, lanceolate to oval, acute to obtuse, equal or unequal in length. Leaves, stems, and parts of flower frequently glandular-granuliferous.

Type species: **Psilostrophe gnaphalodes** DC.

KEY TO THE SPECIES AND VARIETIES

A. Stem white-pannose; shrubby plants; peduncles 3.0–8.0 cm. long ..... 1. P. COOPERI
AA. Stem villous to glabrate, gray to green; herbaceous plants; heads subsessile to long-peduncled.
  B. Achenes and pappus long-villous; heads subsessile or with peduncles mostly less than 0.5 cm.; ligules about 6 mm. long ..... 6. P. GNAPHALODES
  BB. Achenes and pappus glabrous or essentially so; heads long-peduncled (subsessile only in *P. villosa*).
    C. Involucre 7–10 mm. high, 4–6 mm. broad; ligules 4–6, 8–14 mm. long; pappus scales generally ovate, less than half the length of the disk-corolla ..... 2. P. BAKERI
    CC. Involucre 4–6 mm. high, 2–4 mm. broad; ligules 3–5, 3–11 mm. long; pappus scales rarely ovate, generally about half the length of the disk-corolla.
      D. Heads densely clustered, on peduncles mostly less than 0.5 cm.; ligules 3–5 mm. long, deeply lobed ..... 5. P. VILLOSA
      DD. Heads loosely clustered, on peduncles mostly longer than 0.5 cm.; ligules 5 mm. or more long, shallowly lobed.
        E. Plants glabrate to sparingly pilose; stem green, frequently slightly twisted ..... 3. P. SPARSIFLORA
        EE. Plants long-villous, rarely glabrate; stem gray to green, not twisted (except in *P. tagetina* var. *lanata*).
          F. Ligules 5–9 mm. long; peduncles 0.5–2.0 cm. long; upper leaves about 1 cm. long or less ..... 4. P. TAGETINA
          FF. Ligules 6–12 mm. long; peduncles 1.0–4.0 cm. long; upper leaves frequently over 1 cm. long.
            G. Plants densely villous, grayish, about 40 cm. high; basal leaves 5–15 cm. long, frequently lobed; pappus-scales generally acute ..... 4a. P. TAGETINA var. LANATA
            GG. Plants lightly villous, greenish, about 25 cm. high; basal leaves 3–6 cm. long, mostly entire; pappus-scales generally obtuse ..... 4b. P. TAGETINA var. GRANDIFLORA

1. **Psilostrophe Cooperi** (Gray) Greene, Pittonia **2**:176. 1891; Kuntze, Rev. Gen. Pl. **1**:358. 1891; Rydb. in Britt. N. Am. Fl. **34**:9. 1914; Rydb. Fl. Rocky Mts. 939. 1917; Jepson, Man. Fl. Pl. Calif. 1133. 1925; Munz, Man. S. Calif. Bot. 559. 1939; Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 969. 1942 (as *cooperi*).

Riddellia Cooperi Gray in Proc. Am. Acad. **7**:358. 1868; Gray, Syn. Fl. N. Am. **1**^{2}:318. 1884, and ed. 2, 1886.

A shrubby perennial with woody caudex; stems white-pannose, less densely so with age, 25 to 50 cm. high; lower leaves entire, linear, pannose to almost glabrate, 1–7 cm. long, seldom more than 2 cm. broad; upper leaves smaller and sessile; heads scattered; peduncles slender, 3.0–8.0 cm. long; involucre woolly, 6–8 mm. long, 4–5 mm. wide; ligules 4–8, 8–16 mm. long, nearly as broad, 3-lobed; disk-flowers 9–20; achenes glabrous; squamellae various, broadly oblong to lanceolate, erose to entire, obtuse to acute, generally from ¼ to less than ½ the length of the disk-corollas.

Distribution: New Mexico to California into northwestern Mexico. Altitude: 2000–4000 ft.

ARIZONA.—COCHISE CO.: Benson, *Jones 25940* (MBG); Lowell, *Parish 111* (G, MBG, NY, PA, US). GILA CO.: near Rock and Rye Creeks, *Collom 65* (MBG, NY), near Rye Creek, *479* (MBG); 17 mi. from Roosevelt on road to Payson, *Stone 60* (NY). GRAHAM CO.: Tanque, *Eggleston 19890* (US); Camp Grant, *Palmer 140* (G, MBG); Safford, 30 Sept. 1936, *Tharp* (T). GREENLEE CO.: near Clifton, 1 Nov. 1880, *Greene* (G, NY). MARICOPA CO.: New River Valley, 10 mi. s. of Canyon, *Gillespie 8690* (US). MOJAVE CO.: Kingman, 13 Aug. 1911, *Wooton* (US); southern tip of Cerbat Range, about 5 mi. s. w. of Kingman, *Barkley & Blondeau 4186* (MBG); 5 mi. s. w. of Kingman, *Rose 40083* (MBG); 10 mi. from Kingman on Peach Springs road, *Ferris & Duncan 2228* (NY); between Oatman and Kingman, *Degener 4907* (NY); plain near Oatman, April 1916, *Creighton* (PA); Fort Mojave, coll. of 1861, *Cooper* (G TYPE, US); Yucca, *Jones 3891* (FM, NY, PA, US); 30 mi. s. of Littlefield, *Maguire, Maguire & Maguire 5061* (G, MBG). NAVAJO CO.: Silver Lake, *Toumey 639a* (US). PIMA CO.: Tucson, *Demaree 8031* (MBG), *Fisher 155* (G), 11 Oct. 1894, *Hilzinger* (G, NY), *Lemmon Herbarium 46* (G), *Nelson & Nelson 1519* (G, MBG, NY, PA, US), 10 June 1908, *Sherff* (MBG), *Thornber 402* (MBG, NY, US), 16 April 1892, *Toumey s. n., 639b* (US), coll. of 1886, *Vasey* (US), and 1 May 1896, *Zuck* (US); near Tucson, *Peebles, Harrison & Kearney 1279* (US), *Pringle 9845* (NY), *Wiggins 6231* (US); west of Tucson, *Bartram 294* (PA); Picture Rocks, Tucson Mts., *Bartram 295* (US); w. of Tucson Mts., 19 Aug. 1927 and base of Tucson Mts. near Tucson, 24 July 1927, *Graham* (NY); low slopes Tucson Mts., *Bartram 296* (PA); few mi. w. of Carnegie Inst. Desert Lab., foothills of Tucson Mts., *Foster 509* (G); Saguaro Monument, 15 mi. e. of Tucson, *Brass 14330* (G, MBG); Martinez' Ranch, 16 mi. e. of Tucson, *Brass 14263* (G, MBG); between Sells and Tucson, *Gilman 215* (MBG, NY); Covered Wells, *Burnham 291* (FM, NY); Vail, 2 May 1937, *Darrow* (G); Rincon Pass, *Griffiths 2020* (NY); Baboquivari Mts., *Gilman 151* (NY), *Nelson & Nelson 1535* (MBG, NY, US); Tuviaucoc Hill, Tucson, *Harris C1476* (MBG, NY); roadside mine, *Harrison & Kearney 8667* (FM); San Salano, 10 Oct. 1925, *Peebles, Harrison & Kearney* (US); Camp Lowell, *Pringle 13755* (G, MBG, NY, PA). PINAL CO.: Ray, 1 May 1911, *Johnson* (NY). YAVAPAI CO.: Fort Whipple, *Coues & Palmer 254* (G, MBG); Castle Creek, *Toumey 639c* (US); Black Canyon Road near Agua Fria, *Wiegand & Upton 4474* (FM, MBG).

CALIFORNIA.—SAN BERNARDINO CO.: 1 mi. s. of Excelsior Talc Mine, Kingston Mts., Mojave Desert, *Abrams 14104* (G); Providence Mts., 24 May 1902, *Brandegee* (PA); e.

slope of Providence Mts., 29 May 1861, *Cooper* (US); Nipton, June 1915, *Brandegee* (G, FM, MBG, NY, US); Kelso, 2 May 1906, *Jones* (MBG, NY, US); Lanfair Valley, e. Mojave Desert, *Munz 13897* (FM); Seastalk, *Parish 10264* (G, MBG).

NEVADA.—CLARK CO.: Charleston Mts., Carpenter Canyon, *Anderson 7749* (NY, US); Valley of Fire, *Clokey 5952* (MBG, NY, T), *Maguire, Maguire & Maguire 5060* (G); Kyle Canyon, *Clokey 7367* (NY, US); Clark Creek, *Clokey 7369* (FM, NY, US); Kyle Canyon Fan, *Clokey 8177* (G, FM, MBG, NY, PA, T); Trout Creek Canyon Wash, *Clokey & Anderson 7368* (G, FM, NY); fan s. of Trout Creek, *Clokey & Anderson 8176* (G, FM, MBG, NY, PA); Virgin River, Bunkerville, *Goodding 752* (G, MBG); Moapa, *Kennedy 1127* (NY, US); 8 mi. w. of Goodsprings on road to Kingston, *La Rivers & Hancock 294* (MBG); 1 mi. w. of Riverside, *Maguire & Blood 4498* (FM, MBG); junction of Las Vegas and Head of Callville Wash, 2 mi. n. of airport, *Train 1804* (NY); junction of Kyle Canyon and Las Vegas Highway, *Train 1664* (PA). LINCOLN CO.: Searchlight, *Parish 10285* (NY). NYE CO.: Pahrump Valley, *Coville & Funston 292* (US), *Purpus 6125* (PA, US).

NEW MEXICO.—MC KINLEY CO.: road near Zuni, *Schott III 91* (FM).

UTAH.—BEAVER CO.: Beaver, *Palmer 246* (G, MBG, NY, US).

MEXICO.—LOWER CALIFORNIA: San Luis, 22 April 1889, *Brandegee* (G, FM, US); Agua Dulce, *Brandegee* (FM); about 32 mi. from Rosario on road to San Augustine, *Ferris 8553* (US); San Augustine, *Gentry 4003* (MBG); El Marmol, *Harvey 518* (US); Los Angeles Bay, Gulf of California, *Palmer 538* (G, NY, US); coastal terrace along beach 24 mi. s. of Punto Prieta, *Wiggins 7737* (FM).

SONORA: District of Altar, 7 mi. s. of Sonoyta on road to Quitovac, *Keck 4147* (G, US).

2. Psilostrophe Bakeri Greene, Pl. Baker. **3**:29. 1901; Rydb. Fl. Colo. 376. 1906; Coulter & Nels. New Man. Bot. Cent. Rocky Mts. 553. 1909; Rydb. in Britt. N. Am. Fl. **34**:8. 1914; Fl. Rocky Mts. 939. 1917, and ed. 2. 1922.

Riddellia tagetina var. *pumila* M. E. Jones in Proc. Calif. Acad. II. **5**:700. 1895.

P. pumila A. Nels. in Proc. Biol. Soc. Wash. **16**:22. 1903.

A small perennial with woody caudex; stems long-villous, 5–30 cm. high; basal leaves spatulate to obovate, rarely lobed, long-villous, less than 10 cm. long; upper leaves smaller, spatulate to oblanceolate, entire; heads scattered; peduncles 2.0–5.0 cm. long; involucre generally lightly long-villous, 7–10 mm. long, 4–6 mm. wide, bracts apparent; ligules 4–6, 8–14 mm. long, 10 mm. wide, shallowly 3-cleft; disk-flowers 10–18; achenes glabrous; squamellae oval, obtuse, more or less erose, about ⅓ the length of the disk-corolla.

Distribution: western Colorado to southern Idaho. Altitude: 4500–6500 ft.

COLORADO.—DELTA CO.: 30 June 1892, *Cowen* (NY); Hotchkiss, *Cowen 276* (US); Surface Creek, *Purpus 183* (FM); 8 mi. w. of Delta, *Rollins 1970* (G, NY); 2 mi. s. of Delta, *Rollins 2141* (G, MBG); 15 mi. w. of Delta, *Rollins 2155* (G). GARFIELD CO.: Rifle, *Osterhout 2127* (NY). MESA CO.: Grand Junction, *Baker 106* (G, MBG), *Jones 5474* (MBG, NY, US), and 22 May 1895 (US), *Saunders 405* (NY, US); Palisades, *Crandall 2995* (NY), May to August 1893, *Long* (G); Whitewater, *Rollins 1578* (G, MBG). MONTROSE CO.: Montrose, *Baker 14* (G, MBG, US), *Payson 658* (G); Uncompagre Mts. near Los Piños, coll. of 1878, *Flint* (NY).

IDAHO.—CASSIA CO.: near Strevell, *Warren 1416* (US).

UTAH.—KANE CO.: Paria (Pahria) Canyon, *Jones 5296* in part (MBG). GRAND CO.: near Grand Junction, 15 June 1900, *Stokes* (NY, US).

3. **Psilostrophe sparsiflora** (Gray) A. Nels. in Proc. Biol. Soc. Wash. 16:23. 1903; Rydb. in N. Am. Fl. 34:7. 1914; Rydb. Fl. Rocky Mts. 939. 1917; Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 970. 1942.

Riddellia tagetina var. *sparsiflora* Gray, Syn. Fl. N. Am. 1^2:318. 1884, and ed. 2. 1886.

P. tagetina var. *sparsiflora* Greene, Pittonia 2:176. 1891.

P. divaricata Rydb. in Britt. N. Am. Fl. 34:8. 1914, in part.

P. grandiflora Rydb. *loc. cit.* 8. 1914, in part.

A perennial; stems pilose to glabrate above, often glandular-dotted, frequently twisted, 15–45 cm. high; basal leaves spatulate to linear, seldom lobed, very loosely villous, 5–10 cm. long, rarely wider than 1.5 cm.; upper leaves smaller, linear or linear-oblanceolate, and sessile; heads generally few in loose corymbs; peduncles slender, 0.5 cm. or longer; involucre lightly woolly, about 5 mm. long, 3 mm. wide; ligules usually 3, 6–8 mm. long and noticeably wider, shallowly 3-lobed; disk-flowers 10 or less; achenes essentially glabrous to glabrous; squamellae unequal, linear-lanceolate, mostly acute, ½–⅔ the length of the disk-corolla.

Distribution: eastern New Mexico and southern Utah to northern Arizona. Altitude: 3000–6000 ft.

ARIZONA.—APACHE CO.: Navajo Reservation, *Vorbies 56* (G, MBG, NY). COCONINO CO.: Grand Canyon, Aug. 1897, *Allen* (NY), *Eastwood 3692, 5816* (G), Feb.-May 1885, *Gray* (G), 1 July 1915, *Hitchcock* (US), *51, 77* (US), *Knowlton 272* (US), *Toumey 638* (US); Boucher Creek, *Wiegand & Upton 4475* (FM); Le Conte Plateau, 16–19 Oct. 1906, *Pilsbry* (PA); 2 mi. s. of Grand Canyon, *Degener & Park 4411* (NY); ½ mi. e. of Grand Canyon National Park, *Ferris 10213* (G); s. rim of Grand Canyon, 25 mi. n. w. of Cameron, *Carter 1429* (MBG, NY); near Cameron, *Hanson A55* (FM, MBG, PA, T); 42 mi. e. of El Tovar on road to Cameron, *Peebles 13332* (US); Lee's Ferry, Paria [Pahria] Canyon, *Cutler 3135* (NY, MBG); Coconino Forest at Deadman Ranger Station, *Eggleston 17187* (MBG); Falls of the Little Colorado River, *Fulton 7359* (US); 3 mi. n. of the Navajo Bridge, *Rollins & Chambers 2440* (G); 12 mi. s. w. of Tanner's Crossing, 1 June 1901, *Ward* (NY); O'Leary Peak, *Goldman 2893* (US); Flagstaff, 5 Aug. 1922, *Hanson* (US), 7–11 Aug. 1915, *Hitchcock* (US), *MacDougal 229* (G, NY, PA, US), May-Oct. 1901, *Purpus* (MBG, US); near Flagstaff, *Leiberg 5624* (US); 20 mi. n. of Flagstaff, 16 July 1943, *Huffman* (NY); 10 mi. e. of Jacob Lake, 16 July 1943, *Huffman* (NY); along U. S. Highway #66 between Peach Springs and Hyde Park, *Heller 15777* (MBG, NY); Cosnino, *Jones 4038* (NY); below Nagle's Ranch, *Jones 6050a* (US); San Francisco Mts., *Knowlton 182* (US); w. of Echo Cliffs, *McKelvey 4454* (G); Wupatki National Monument, *Whiting 756/892* (US). MOHAVE CO.: n. end of Toroweap Valley, *Cottam 6589* (MBG); Peach Springs, *Degener 4900* (NY); 6 mi. w. of Peach Springs, *Kearney & Peebles 12741* (US); Trumbull, *Palmer 246½* (G, MBG, NY, US); Johnson's Canyon, *Rusby 657* (FM, MBG, NY, US) and *4734* (MBG, US). NAVAJO CO.: Laguna Canyon, Keet Leil Ruin, *Clute 24* (G, MBG, NY, US), and *24a* (NY); Betatakin, *Eastwood & Howell 6604* (US); s. of Winslow, *Peebles 9539* (US).

NEW MEXICO.—COUNTY NOT DETERMINED: Mesa la Vecas, 18 Sept. 1883, *Marsh* (US); no locality given, coll. of 1867, *Parry* (US).

UTAH.—GARFIELD CO.: *Siler* (PA). KANE CO.: Pahria Canyon, *Jones 5296* in part (MBG, NY, US); 10 mi. s. of Pahria, *Jones 5291i* (US); 2 mi. n. e. of Kanab to Red Canyon, *Stone 276* (NY); Kanab, coll. of 1872, *Thompson* (G, MBG). COUNTY NOT DETERMINED: *Bishop* (G TYPE, FM); *Vasey* (FM); Cainville, *Jones 5696e* (US).

4. Psilostrophe tagetina[18] (Nutt.) Greene, Pittonia **2**:176. 1891; Britt. & Brown, Ill. Fl. **3**:444. 1898 (as *"Tagetinae"*); A. Nels. in Proc. Biol. Soc. Wash. **16**:22. 1903; Rydb. Fl. Colo. 376. 1906; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 553. 1909; Rydb. in Britt. N. Am. Fl. **34**:8. 1914 (as *"Tagetinae"*); Rydb. Fl. Rocky Mts. 939. 1917 (as *"Tagetinae"*); Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 969. 1942 (as *"tagetinae"*).

Riddellia tagetina Nutt. in Trans. Am. Phil. Soc. II. **7**:371. 1841 (as *"Tagetinae,"* sphalm.); Torr. & Gray, Fl. N. Am. **2**:362. 1842; Torr. in Emory, Notes Mil. Reconnois. p. 143, *pl. 5*. 1848; Gray in Mem. Am. Acad. II. **4**:94. 1849; Gray, Syn. Fl. N. Am. 1^2:317. 1884, and ed. 2. 1886.

P. Hartmanii Rydb. in Britt. N. Am. Fl. **34**:8. 1914.

P. divaricata Rydb. *loc. cit.*, in part.

A perennial, generally woody at the base; stems densely to lightly villous, occasionally glabrate, 10–50 cm. high; basal leaves ovate to oblanceolate, usually spatulate, entire or pinnately lobed, densely to lightly villous, 2–10 cm. long, less than half as wide; upper leaves linear to oblanceolate, smaller and greener than the basal leaves; heads generally numerous in dense to loose corymbs; peduncles usually 0.5–2.0 cm. long; involucre usually densely woolly, 5–6 mm. long, 3–4 mm. wide; ligules 3–5, 5–9 mm. long, 3 (rarely 4 or 5) shallowly lobed; disk-flowers 6–12; achenes glabrous or with a few short and scattered hairs; squamellae various, lanceolate to lance-elliptic, obtuse to acute, entire to erose, and from ⅓ to ⅔ the length of the disk-corolla.

Distribution: western Texas to eastern Arizona into northern Mexico. Altitude: 3000–8000 ft.

ARIZONA.—APACHE CO.: White Mts., Hondo Hill, 28 July 1905, *Wooton* (US); Adamana to "Long H" Ranch, *Griffiths 5173* (US). COHISE CO.: Chiricahua Mts., Paradise, 4 July 1937, *Darrow* (G); Portal to Paradise, *Eggleston 10650* (US); desert between the Chiricahuas and the Southern Pacific Railroad, 6 mi. s. of Dos Cabezas, *Stone 184* (PA); Camp Bowie, *Rothrock 463* (FM, G, PA, US). GREENLEE CO.: San Francisco Mts. (?), 21 July 1864, *Anderson* (MBG). COUNTY NOT DETERMINED: Moki Reservation and Little Colorado River, *Hough 115* (US).

NEW MEXICO.—BERNALILLO CO.: 10 mi. w. of Albuquerque, *Rollins & Chambers 2418* (G). CATRON CO.: Beaverhead, *Eggleston 20399* (G); Mangas, *Smith 25* (US), 19 Oct. 1897, *Metcalfe* (US); Reserve, 9 July 1906, *Wooton* (G); Mogollon Mts., Gila Hot Springs, 20 Aug. 1900, *Wooton* (US); Tularosa Creek, 8.4 mi. w. of the Continental Divide on the road from Magdalena to Reserve, *Goddard 810* (MBG). CHAVES CO.: Roswell, *Earle & Earle 374* (MBG, NY, US); 20 mi. s. of Roswell, 20 Aug. 1900, *Earle & Earle* (NY); Arroyo Ranch near Roswell, *Griffiths 5741* (MBG). COLFAX CO.: Raton Mts., Aug. 1867, *Bell* (MBG, PA). DONA ANA CO.: s. w. Pyramid Peak, *Fosberg 53318* (G, MBG, US); w. of Organ Mts., 1 May 1906, *Standley* (MBG); Organ Mts., Van Patten's, 11 June 1906, *Standley* (US); Tortugas Mt., *Standley 6445* (US); Los Cruces, *Wooton 6* (G, MBG, NY, US); Mesilla Valley, *Wooton & Standley 3320* (FM, MBG, NY), 1 June 1906, *Standley* (MBG), May 1906, *Wooton* (T); Mesilla Park, 23 May 1900, *Cockerell* (NY); Doñana, *Wislizenus 82* (G, MBG); Strauss' Station, *Mearns*

[18] Nuttall's spelling in the original work, *"Tagetinae,"* which is gramatically incorrect, is probably a misprint. In letters to the author, Mr. C. A. Weatherby and Dr. S. F. Blake are of the opinion that the spelling *"tagetina"* should be used as was done by Torrey and Gray, *loc. cit.*

1525 (US); between Strauss and Anapra, *Stearns 384* (US); Monument #40, Mexican Boundary Line, *Mearns 253* (US). EDDY CO.: Pecos Valley near Texas line, *Bailey 746* (US); Dark Canyon, Rocky Arroyo Road, 45 mi. n. w. of Carlsbad, *Grassel 26* (FM); near Loving, *Standley 40359* (US); near mouth of South Fork, Guadalupe Mts., *Wilkens 1790* (PA). GRANT CO.: Wind Canyon, 7–8 mi. n. of Cliff, *Eggleston 16538* (FM, MBG); near Santa Rita del Cobre, coll. of 1877, *Greene* (FM); plains of the Gila, 2 July 1880, *Greene* (PA); Fierro to Santa Rita, 27 Aug.-12 Sept. 1911, *Holzinger* (MBG, US); Mangas Springs, 18 mi. n. w. of Silver City, *Metcalfe 124* (G, MBG, NY), and *648* (MBG, NY, US); near Pinos Altos, 26 June 1936, *Stewart* (MBG); Bear Mt., 5 mi. from Silver City, *Wolf 2623* (G). GUADALUPE CO.: Santa Rosa, *Whitehouse 7314* (T); 8 mi. s. of Santa Rosa, *Hubricht, Shoop & Heinze* (MBG). LINCOLN CO.: Lincoln, 31 July 1900, *Earle & Earle* (NY); 5 mi. w. of Lincoln, *Hitchcock, Rethke & van Raadshooven 4276* (G). MC KINLEY CO.: Fort Defiance, *Friese* (PA); Camp #1, Rio Zuni, 24 Sept. 1851, *Woodhouse* (PA). OTERO CO.: *Archer 7303* (NY), *7304* (NY, PA); Mescalero, 3 Aug. 1931, *Huber* (PA); Sacramento Mts., Alamo Canyon, 8–10 Oct. 1932, *Pilsbry* (PA); 4 mi. above Tularosa, *Wooton & Standley 3615* (US). QUAY CO.: Nara Vista, *Fisher 3* (US); Tucumcari, *Fisher 30* (US). RIO ARRIBA CO.: near El Rito, *Rusby 175½* (PA). SANTA FE CO.: Galisteo, vicinity of Santa Fe, *Arsène & Benedict 15817* (PA); 10 mi. w. of Santa Fe, *Heller & Heller 3739* (G, MBG, NY, US). SANDOVAL CO.: Jemez Springs, *Nelson 11671* (G, MBG); Algodones, *Rothrock 82* (FM). SAN MIGUEL CO.: Las Lagunitas, 14 mi. s. of Las Vegas, *Brandegee 11794* (MBG). SIERRA CO.: Lake Valley, coll. of 1914, *Beals* (US); road from Kingston to Tierra Blanca, *Eggleston 16323* (FM, G, NY). SOCORRO CO.: between Nogal Canyon and San Marcial, *Ferris & Duncan 2348* (MBG); Magdalena, *Herrick 651* (FM); Water Canyon, Magdalena Mts., *Herrick & Herrick 108, 137* (FM). TAOS CO.: Barranca Station, 28 Aug. 1894, *Smith* (PA); near Barranca, 28 Aug. 1894, *Smith* (PA). VALENCIA CO.: Cebolla Springs, *Bailey 1072* (US); Laguna, *Collins 11* (PA); e. of Laguna Pueblo on Highway #66, *Nelson & Nelson 2179* (MBG). COUNTY NOT DETERMINED: 66 mi. e. of Albuquerque, 14 July 1943, *Huffman* (NY). NO LOCALITY GIVEN: *Fendler 461* (FM, G, MBG, NY, PA, US).

TEXAS.—BREWSTER CO.: Panther Springs, *Marsh 79* (FM); Chisos Mts., *Mueller 8231* (G, MBG, NY, T), 22–24 Nov. 1922, *Pilsbry* (PA); Willow Creek and Green Gulch Canyons, *Sperry 250* (US); Lower Green Gulch, *Warnock 1232* (G); Mesa de Anguila, *Warnock 726* (US), 13 Aug. 1915, *Young* (MBG, T); Rock Spring Canyon, 24 Aug. 1915, *Young* (T); banks of Rio Grande in Grand Canyon near Castellan, *Palmer 34216* (NY). CONCHO CO.: Rio Concho, *Thurber 76* (G, NY). CULBERSON CO.: 9 mi. e. of Van Horn, *Waterfall 4149* (G); 40 mi. n. e. of Van Horn, *Waterfall 5008* (G); 1.5 mi. e. of Daughtery, *Waterfall 5181* (G); Guadalupe Mts., *Bailey 701* (US), 15 Aug. 1916, *Young* (T), 28 Aug. 1916 (MBG); Pine Springs, *Cory 17611* (G); Miller Brothers Ranch, *Cory 2695* (G). EL PASO CO.: coll. of 1858, El Paso, *Dieffenderfer* (PA), *Fisher 173* (MBG), *Rose 1193* (G, US); w. of El Paso, 15 June 1891, *Dewey* (US); n. of El Paso, *Ferris & Duncan 2380* (MBG); 1.5 mi. s. of Newman, *Waterfall 3940* (G); along Highway #62, between El Paso and Hueco, 6–16 mi. e. of El Paso, *Waterfall 3888* (G); in Hueco Mts., near Highway #62, *Waterfall 3928* (G). HUDSPETH CO.: 2 mi. w. of Salt Flats, *Waterfall 3846* (G); vicinity of Ft. Quitman, *Waterfall 3994* (G); 3 mi. e. of Sierra Blanca, *Waterfall 4017* (G); 4 mi. w. of Sierra Blanca, *Ferris & Duncan 2488* (MBG, NY); Ft. Hancock, 23 June 1891, *Evans* (MBG). JEFF DAVIS CO.: near Ft. Davis, *Palmer 32083* (MBG, PA, T); Ft. Davis, *Blake* (NY); Davis Mts., near Rockpile Ranch, 21 Aug. 1940, *Hinckley* (G). MAVERICK CO.: Eagle Pass, 10 Nov. 1893, *Plank* (NY). MITCHELL CO.: *Goldstein* (PA). PRESIDIO CO.: Marfa, *Eggleston 17285* (G, NY), *Hinckley 652* (FM, T); near Marfa, *Drushel 10499* (PA). REEVES CO.: vicinity of Pecos, *Gillespie 5263* (G, US). WARD CO.: Barstow, *Earle & Tracy 42* (NY), *Tracy 8164* (NY, T, US), *Earle 643* (NY); Pyote, 19 May 1900, *Williams* (US). COUNTY NOT DETERMINED: road between El Paso and Hueco, N. Mex., *Mulford 111* (MBG, NY); Comanche Plains, 2 Sept. 1853, *Bigelow* (US); along Rio Grande, *Hayes 469* (FM, NY).

MEXICO.—CHIHUAHUA: Cuidad Juarez, *Pringle 9954* (G, MBG, NY, US); valley around Juarez, 1912, *Stearns* (MBG); foothills of the Sierra Madre, near Colonia Juarez, *Nelson 6319* (G, US); Colonia Diaz, *Nelson 6441* (G, US); Chihuahua, *Le Sueur 54* (FM, G, T); near Laguna de Guzman, *Hartman 726* (G); Casas Grandes, *Hartman 807* (FM, G, NY, PA, US); near Casas Grandes, *Townsend & Barber 364* (MBG, NY, US); 1 mi. e. of Pozo de Villa on Coahuila boundary, *Johnston 8183* (G); Sierra San Carlos, *Johnston & Muller 67* (G); Cañon del Rayo, Sierra del Diablo, *Stewart 884* (G); 4 km. n. of Fierro, Sierra de Encinillas, *Stewart 801* (G).

COAHUILA: Muzquiz, 20 mi. n. w. of Hacienda La Babia, *Wynd & Mueller 432* (G, MBG, NY, US); Municipio de Cuatro Cinegas, Rancho Falcon, Cuesta del Dulce, about 12 mi. w. of Hacienda Berrendo, *Wynd 723* (G); near Otto, 6 Sept. 1906, *Johnson* (US); base of Picacho del Fuste, *Johnston 8437* (G); Sierra de las Cruces, Santa Elena Mines, *Johnston & Muller 1382* (G); n. e. from Tanque Armendais, *Johnston & Muller 760* (G); Del Carmen Mts., *Marsh 901* (FM, G); Sierra de Santa Rosa, *Marsh 1233, 1340, 1522* (G); Sierra del Carmen, *Stewart 1572* (G); 3 km. s. of El Tule, *Stewart 544* (G); 2 km. n. of Agritos, *Stewart 1273* (G); western base of Sierra de los Guajes, 4 km. e. of Rancho Buena Vista, *Stewart 1485* (G); 8 km. n. w. of Santa Elena, *Stewart 2161* (G).

STATE NOT DETERMINED: chiefly in the Valley of the Rio Grande below Doñana, *Mexican Boundary Survey 628* in part (NY, US); near Olla, near the banks of the Rio Grande, *Wislizenus 36* (MBG); Long's Expedition, *James* (G).

4a. Psilostrophe tagetina var. **lanata** A. Nels. in Proc. Biol. Soc. Wash. **16**:22. 1903.

P. lanata Anon. in Proc. Biol. Soc. Wash. **16**:186 (Index). 1903; Rydb. in Britt. N. Am. Fl. **34**:8. 1914.

Densely villous on the caudex, stems generally long-villous, gray, thick, occasionally twisted, mostly 40 cm. high; basal leaves spatulate, frequently lobed, long-villous, 5–15 cm. long; upper leaves linear-oblanceolate to spatulate, occasionally lobed, 1–7 cm. long; peduncles mostly 1.0–3.0 cm. long; involucre 6–7 mm. long, 3–4 mm. wide; ligules 3–5, 6–12 mm. long; squamellae lance-elliptic to oblong, rarely lanceolate, acute to obtuse; otherwise as in the species.

Distribution: western Texas to southern Utah into northern Mexico.

NEW MEXICO.—EDDY CO.: Guadalupe Mts., South Fork, *Wilkens 1738* (PA). OTERO CO.: Hueco, 23 Aug. 1911, *Barlow* (FM); no locality given, 7 April-24 May 1902, *Rehn & Viereck* (PA), 21–28 May, *Viereck* (PA). SOCORRO CO.: Magdalena, *Herrick 643* (US).

TEXAS.—BREWSTER CO.: Boquillas, *Hanson 608* (MBG, US), and *650* (US); Santa Helena Canyon, Rio Grande, *Innes & Warnock 501* (G); between Marathon and Persimmon Gap, *McKelvey 1974* (G), and *1980* (G, US); e. of Chisos Mts., *Sperry 1709* (G). CULBERSON CO.: Kent, *Tracy & Earle 42* (G, NY, T, US). EL PASO CO.: *Jones 3718* (NY, PA, US), *Meebold 22544* (NY), and coll. of 1881, *Vasey* (G); Fort Bliss, 30 April 1915, *Carlson* (G, NY). HUDSPETH CO.: Sierra Blanca, *Jones 25943* (MBG).

UTAH.—SAN JUAN CO.: 10 mi. s. of Moab, 4 July 1942, *Huffman* (NY).

MEXICO.—CHIHUAHUA: Valley of the Rio Grande, Paso del Norte, *Pringle 71* (G, NY, PA, US); hills near Chihuahua, *Pringle 71½* (MBG, NY); vicinity of Chihuahua, *Palmer 164* (FM, G, MBG, NY, US); Santa Eulalia, 18 Aug. 1885, *Wilkinson* (US).

COAHUILA: Sierra Mojada Mts., *Jones 285* (US).

STATE NOT DETERMINED: Valley of the Rio Grande below Doñana, *Mexican Boundary Survey 629* (US CO-TYPE).

4b. Psilostrophe tagetina var. **grandiflora** (Rydb.) Heiser, n. comb.

P. grandiflora Rydb. in Britt. N. Am. Fl. **34**:8. 1914, in part.

P. sparsiflora Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 970. 1942, in part.

Stems green, lightly villous, 25 cm. or taller; lower leaves spatulate, generally entire, lightly villous, 3–6 cm. long; upper leaves linear to spatulate, 1–5 cm. long, entire, green; peduncles slender, 1–4 cm. long; involucre 6 mm. long, 3–4 mm. wide; ligules broad, 7–12 mm. long; squamellae lance-elliptic to lance-oblong, obtuse, rarely acutish, ½ or less the length of the disk-corolla; otherwise as in the species.

Distribution: with the species in southeastern Arizona and southwestern New Mexico.

ARIZONA.—COCHISE CO.: Chiricahua Mts., near Cedar Gulch, Paradise, *Blumer 1709* (G, MBG TYPE COLLECTION), and *88* (US); Silver Creek, about Portal, *Eggleston 10945* (G, US); Apache Pass, Sept. 1881, *Lemmon Herbarium* (FM); Fort Bowie, 3–30 Nov. 1906, *Pilsbry* (PA).

NEW MEXICO.—GRANT CO.: Apache Tejo, *Mulford 941* (MBG, NY). HIDALGO CO.: e. side of San Luis Mts., *Mearns 2186* (NY); Animas Creek, *Metcalfe 1144* (G, NY, US). SOCORRO CO.: Socorro, May 1881, *Vasey* (US).

5. Psilostrophe villosa Rydb. in Britton, Man. 1006. 1901; Britt. & Brown, Ill. Fl. ed. 2, **3**:504. 1913; Small, Fl. Southeastern U. S. ed. 2, 1372. 1913; Rydb. in Britt. N. Am. Fl. **34**:7. 1914; Rydb. Fl. Prair. & Plains, 852. 1932; Stemen & Meyers, Okla. Fl. 594. 1937.

P. cerifera A. Nels. in Proc. Biol. Soc. Wash. **16**:21. 1903.

P. cerifera var. *biennis* A. Nels. *loc. cit.*

P. biennis Anon. in Proc. Biol. Soc. Wash. **16**:186 (Index). 1903.

A biennial or perennial; stems loosely to densely long-villous, 10–60 cm. high; basal leaves spatulate to oblanceolate, entire, or some 3–5-lobed, short-petioled, 5–10 cm. long; upper leaves smaller and sessile, rarely lobed; heads several in a small congested corymb, on peduncles less than 0.5 cm. long, or subsessile; involucre densely woolly, 5 mm. long, 3 mm. wide; ligules 3–4, 3–5 mm. long, 3-lobed about half of their length or sometimes 4-lobed; disk-flowers 5–12, usually 6–8; achenes glabrous or essentially so; squamellae linear-lanceolate, acute, ½ or over the length of the disk-corolla.

Distribution: southern Kansas to Texas and eastern New Mexico. Altitude: 500–5000 ft.

KANSAS.—BARBER CO.: *Hitchcock 741* (G, MBG, NY, US). CLARK CO.: near Sitka, *Palmer 41863* (MBG); on Cimarron, 8 mi. s. of Sitka, *Rydberg & Imler 1120* (NY). COMANCHE CO.: 8 mi. w. of Coldwater, *Rydberg & Imler 716* (MBG, NY). MEADE CO.: Meade, July 1892, *Hitchcock* (MBG), 26 June 1888, *Kellerman* (MBG, NY, PA, US); 7 mi. w. of Meade, *Rydberg & Imler 796a* (NY); near Crooked Creek, *Smyth 140* (NY).

NEW MEXICO.—COUNTY NOT DETERMINED: Upper Canadian, April 1848, *Gordon* (MBG); no locality given, *Heary* (PA), *Wright 1259* (G, NY, PA).

OKLAHOMA.—CUSTER CO.: 2 mi. w. of Weatherford, *Hubricht, Shoop & Heinze B1389* (MBG); 1 mi. w. and 1 mi. s. of Weatherford, *Waterfall 5511* (G); Weatherford, 18 May 1937, *Waterfall* (NY). ELLIS CO.: near Shattuck, *Clifton 3200* (G). HARMON CO.: near Hollis, *Stevens 1052* (G). HARPER CO.: near Horbick's, *Stevens 258½* (G). MAJOR CO.: near Waynoka, *Stevens 593* (G); Glass Mts., *White 141* (MBG, NY), and

164 (MBG). WASHITA CO.: near Rocky, *Stevens 973* (G). WOODS CO.: near Fairvalley, *Stevens 715* (G, MBG, NY, US), and *1637* (G).

TEXAS.—BAILEY CO.: Coyote Lake, *Ferris & Duncan 3459* (MBG); 1 mi. n. w. of Muleshoe, *Cory 37520* (G). BAYLOR CO.: Seymour, *Reverchon 505* in part (MBG, US). BREWSTER CO.: Marathon, 14 June 1931, *Tharp 286* (MBG, NY, T). BRISCOE CO.: Quitaque, 29 April 1934, *Tharp* (NY, T); Floyds Crossing, Tule Creek, *Reed & Demaree 7636* (US). CALDWELL CO.: Clear Fork, 10 May 1858, *Hayes* (NY). CHILDRESS CO.: 11 mi. n. of Childress, *Innes & Moon 1004* (G). COKE CO.: 1.5 mi. s. w. of Silver, *Cory 5322* (G); Fort Chadbourne, 1856, *Swift* (PA). DALLAM CO.: 6 mi. w. of Dallam, *van Gorder 49* (T). DAWSON CO.: 8 mi. n. of Lamesa, *Innes & Moon 1061* (G). DONLEY CO.: 5¾ mi. n. w. of Memphis, *Cory 13478* (G). FISHER CO.: Rotan, April and May 1933, *Brookes* (T). FLOYD CO.: Quitaque-Plainview Road, *Ferris & Duncan 3371* (MBG). GARZA CO.: near the "Cap Rock", *Ruth 1283* (US). HALL CO.: Estelline, 8 and 9 July 1903, and 23 May 1904, *Reverchon* (MBG). HEMPHILL CO.: on Canadian, 10 Aug. 1900, *Eggert* (MBG). HOWARD CO.: Big Spring[s], *Bray 416* (T, US), *Letterman 25* (MBG, US). HUDSPETH CO.: Salt Basin, 6 Aug. 1916, *Young* (T). HUTCHINSON CO.: July 1934, *Shepard* (T). JEFF DAVIS CO.: Davis Mts., 13 Aug. 1914, *Young* (T). LISCOMB CO.: Liscomb, *Howell 51, 52* (US). LIVE OAK CO.: *Schulz 38-39* (FM), 27 June 1941, *Tharp* (T). LUBBOCK CO.: Boll's Ranch, 10 mi. s. e. of Lubbock, *Demaree 7668* (G, MBG, US); Johnson's Ranch, Lubbock, *Reed 3408* (US); vicinity of Lubbock, *Reed 3094* (US); Posey, *Demaree 7572, 7773* (US). MITCHELL CO.: on Colorado, 8, 9, and 10 June 1900, *Eggert* (MBG); Colorado, *Tracy 7875* (G, NY, T, US); Loraine, *Finley 3* (T). NOLAN CO.: Sweetwater, 22 June 1891, *Evans* (MBG), *Palmer 12472, 13050* (MBG); near Blackwell, *Palmer 34573* (MBG, PA, US). POTTER CO.: Amarillo Creek, *Reverchon 3328* (MBG). RANDALL CO.: Palo Duro Canyon, *Ball 1222, Cory & Ball 1709* (US), *Reverchon 3328A* (M); Canyon [City], *Palmer 12520* (MBG, US), *14049* (MBG), 13 Aug. 1900, *Eggert* (MBG), 5 Aug. 1903, *Reverchon* (MBG). REAGAN CO.: *Cory 4666* (G); 15 mi. n. w. of Stiles, *Cory 15195* (G); Best, May 1931, *Graves* (T). REEVES CO.: 3 mi. w. of Pecos, *Waterfall 4383* (G). SAN PATRICIO CO.: 5 April 1932, *Tharp* (T). TAYLOR CO.: April 1882, *Reverchon 505* in part (FM, US). TERRELL CO.: near Feodora, *Palmer 33542* (NY). TERRY CO.: Brownfield, *Reed 3799* (T). VALVERDE CO.: high bridge of the Pecos, 27–28 April 1903, *Pilsbry* (PA); Del Rio, 22–23 April 1903, *Pilsbry* (PA); near Del Rio, *Palmer 11088* (MBG, PA, US); Devils River, *Orcutt 6028* (MBG). WEBB CO.: Toga, 1883, *Holstein* (PA). WICHITA CO.: *Boll 505* (FM). COUNTY NOT DETERMINED: Fort Smith to Rio Grande, Comanche Plains, *Bigelow 2* (NY).

6. Psilostrophe gnaphalodes DC. Prodr. **7**:261. 1838; A. Nels. in Proc. Biol. Soc. Wash. **16**:20. 1903; Rydb. in Britt. N. Am. Fl. **34**:7. 1914.

Riddellia arachnoidea Gray in Mem. Am. Acad. II. **4**:94. 1849; Gray, Syn. Fl. N. Am. **1**[2]:318. 1884, and ed. 2, 1886; Coulter in Contr. U. S. Nat. Herb. **2**:226. 1892.

R. gnaphalioides O. Hoffm. in Bull. Herb. Boiss. **3**:628. 1895.

A biennial; stems rather densely villous, 10–50 cm. high; basal leaves spatulate to oblanceolate, occasionally lobed, loosely long-villous to pannose, up to 8 cm. long and 2 cm. wide; upper leaves smaller, oblanceolate to linear; heads several in a congested corymb, on peduncles less than 0.5 cm. long to subsessile; involucre densely woolly, 5–6 mm. long, 3 mm. wide; ligules 3–4, 5–7 mm. long, slightly 3-lobed; disk-flowers 8–12; achenes and squamellae of the pappus densely long-villous; squamellae subulate to lanceolate, acute, about ½ the length of the disk-corolla.

Distribution: southern Texas to central Mexico. Altitude: 1000–7000 ft.

TEXAS.—BRAZOS CO.: College Station, 10 June 1891, *Dewey* (US). BREWSTER CO.: Stewart's, *Cory 2688* (G); 60 mi. s. of Alpine, *Innes & Moon 1168* (G); near Alpine, *Palmer 30590a* (MBG); Alpine, *Sperry T346* (US), *Wiegand & Wiegand 2597* (G); Terlingua, *Reed 1811* (US); between Terlingua and Marathon, *Schulz 3001* (FM); Marathon, *von Schrenk 37, 42* (MBG); s. of Santiago Peak, *Ferris & Duncan 2757* (MBG); Chisos Mts., *Sperry 743* (US), 24 Aug. 1915, *Young* (T). CULBERSON CO.: Van Horn Flats, 7 and 10 July 1900, *Eggert* (MBG); 7 mi. n. of Van Horn, *Waterfall 5125* (G); 9 mi. s. w. of Van Horn, *Waterfall 4681* (G); s. of Eagle Mt., *Waterfall 4437* (G). DIMMIT CO.: Carrizo Springs, *Hoaglund 7303, 7313* (T). EL PASO CO.: e. of El Paso, 21 May 1898, *Bray* (T). HUDSPETH CO.: Indian Hot Springs, *Jones 36415* (MBG); 6 mi. n. e. of Indian Hot Springs, *Waterfall 4837* (G). JEFF DAVIS CO.: Limpia, 16 May 1915, *Allen* (T); 2.8 mi. n. of Fort Davis, *Cory 17685* (G); Davis Mts., between Little and Big Aguja Canyons, *Moore & Steyermark 3114* (G, MBG, PA, US); n. edge of Davis Mts., 5 mi. e. of Kent, *Rollins & Chambers 2757* (G); Davis Mts., *Tracy & Earle 208* (T, US). KENNEDY CO.: 6 Aug. 1925, *Tharp* (T). MAVERICK CO.: Eagle Pass, 25 May 1898, *Bray* (T); 10 mi. e. of Eagle Pass, 9 May 1898, *Bray* (T). MONTGOMERY CO.: Stockton, *Havard 45* (US), and *Reverchon 505* in part (MBG). PATRICIO CO.: 5 April 1932, *Tharp* (T). PECOS CO.: on Marathon Road, 11 mi. s. of Fort Stockton, *Cutak 1, 2* (MBG); Stockton-Sheffield, 3 May 1940, *Tharp* (T); Fort Stockton, 3 Nov. 1913, *Wooton* (US). REEVES CO.: Balmorhea Road, *Tharp 7311* (T). REAGAN CO.: Best, May 1931, *Groves* (T). STARR CO.: *Drushel 6280* (MBG); Rio Grande City, *Tharp 7315* (T). UVALDE CO.: w. of Uvalde, 26 April 1931, *Jones* (MBG). VALVERDE CO.: Langtry, 6 Sept. 1900, *Earle & Earle* (NY), *Orcutt 6318* (MBG); Devil River, *Earle & Earle 446* (MBG, US), *Tharp 3886* (PA); Del Rio, *Fisher 3219* (FM), *Jones 25900* (MBG); Comstock, *Palmer 11055* (MBG, PA, US). WEBB CO.: between San Ignacio and Laredo, *Clover 1689* (T); Laredo, *Palmer 11267*, and 21 March 1903, *Reverchon* (MBG); Greene, 7 April 1901, *Eggert* (MBG). COUNTY NOT DETERMINED: Del Rio to Cotulla, 40 mi. w. of Cotulla, *Hanson 701* (NY, US); western Texas to El Paso, *Wright 380* (G, MBG, US); between Uvalde and Del Rio, *McKelvey 1894* (G).

MEXICO.—CHIHUAHUA: between San Mateo and Guasarachi, *Goldman 145* (G, NY, US); Parral, 1914, *Mathews* (MBG); Los Reyes, about 8 mi. s. of Ciudad Jimenez, *White 2117* (G).

COAHUILA: Saltillo, *Adole 6349* (US), *Arsène 3446* (US), *Gregg 318* (G, PA), *Nelson 6716* (G, US), *Palmer 35* (FM, G, MBG, NY, US), *Safford 1296* (US); Buena Vista, *Gregg 35* (G), *749* (MBG), *Wislizenus 303* (MBG); Fraile, 59 kilo. s. of Saltillo, *Stanford, Retherford & Northcraft 257* (MBG, G); road from Monclova to Saltillo, 1 mi. s. of Hipolito, *Johnston 7238* (G); Hipolito, between Hacienda La Rosa and Hacienda Lechuguilla, *Wynd & Mueller 59* (G, MBG, NY, US); 6 mi. s. w. of Hipolito, *Mueller 3012* (G); Monclova, *Nelson 6154* (G, MBG), *Palmer 679* (G, PA, US), *Marsh 1821* (G); Hermanas, *Marsh 1613* (G); Muzquiz, *Marsh 523* (FM, G, T), *1050, 1114, 1142* (G); 5 mi. n. of Allende, *Johnston 7009* (G); De las Neuvas a la Pena, *Berlandier 2471* (G, PA); 20 mi. w. of Gloria, *Drushel 9687* (US); Torreon, *Juzepczuk 683* (US); Correon, *Pittier 507* (US); Jaral, *Pringle 9040* (G, NY, US); Jimulco, *Pringle 216* (G); 11 kilo. n. e. of Jimulco, *Stanford, Retherford & Northcraft 31* (G, MBG); 9 kilo. s. of Parras on Sierras Negras, *Stanford, Retherford & Northcraft 159* (G, MBG); 15 kilo. w. of Concepcion del Oro, *Stanford, Retherford & Northcraft 550* (G, MBG).

DURANGO: near Mapimi, *Gregg 466* (MBG); near Ojo de San Bernardo, *Gregg 34* (G), *509* (MBG); near Pedricena, *Juzepczuk 573* (US).

NUEVO LEON: Monterrey, *Abbon 6426* (US); coll. of 1828, *Berlandier* (G fragment), *Palmer 678* (FM, G, MBG, US); s. of Nuevo Laredo on road to Monterrey, *Frye & Frye 2354* (G, MBG, NY); 17 mi. s. e. of Galeana, *Mexican Biological Expedition of Students of the University of Illinois 1025* (FM, G, MBG, NY); Galeana, *Chase 7644* (FM, G); Rancho Resendez, Lampazos, *Edwards 390* (FM, MBG, T); Sabinas Hidalgo, *Kenoyer 43* (FM, MBG); 7 mi. s. of Sabinas Hidalgo, *Mueller 2627* (G); 15 mi. n. of Cienega de Flores, *Shreve 9428* (G); 15 mi. w. of Icamole, *Safford 1266a* (US); 22 mi. n. w. of Ascension, *Shreve & Tinkham 9742* (G); along highway passing through Vallecillo,

Langman 1970 (PA); Laredo–Mexico highway, *Langman 2902* (PA); Laredo–Monterrey highway, *Langman 2443* (PA).

SAN LUIS POTOSI: San Luis Potosi, *Berlandier 1336* (FM photograph of TYPE, G); Charcas, *Lundell 5169* (US); near Salado, *Shreve 9356* (G, PA).

SONORA: *Schott* (FM).

TAMAULIPAS: Jaumave, *von Rosynski 305* (NY, US), *328* (FM).

ZACATECAS: 4 mi. s. of Cardona, *Johnston 7378* (G); Caopas, *Lloyd & Kirkwood 3* (MBG, US), *150* (G); near Concepcion del Oro, *Palmer 380* (FM, G, MBG, NY, US); near Calera, *Seler 552* (G).

STATE NOT DETERMINED: Valley of the Rio Grande, below Doñana, *Mexican Boundary Survey 628* in part (US).

List of Exsiccatae

The numbers in *italics* refer to the collection number, the number in parentheses to the species or variety under which the specimen is cited. The abbreviation *s. n.* indicates that the specimen is without a collector's number.

Abbon, J. *6426* (6).
Abrams, L. R. *14104* (1).
Adole, L. *6349* (6).
Allen, T. F. *s. n.* (3).
Allen, ——. *s. n.* (6).
Anderson, Lt. A. *s. n.* (4).
Anderson, R. C. *7749* (1).
Archer, W. A. *7303, 7404* (4).
Arsène, G. *3446* (6).
Arsène, G. & Benedict. *15817* (4).
Bailey, V. *701, 746, 1072* (4).
Baker, C. F. *14, 106* (2).
Ball, C. R. *1222* (5).
Barlow, B. *s. n.* (4a).
Barkley, F. A. & R. Blondeau. *4186* (1).
Bartram, E. B. *294, 295, 296* (1).
Beals, I. M. *s. n.* (4).
Bell, W. A. *s. n.* (4).
Berlandier, J. L. *s. n., 1336, 2471* (6).
Bigelow, J. M. *s. n.* (4); *2* (5).
Bishop, Capt. F. *s. n.* (3).
Blake, S. F. *s. n.* (4).
Blumer, J. C. *88, 1709* (4b).
Boll, J. *505* (5).
Brandegee, K. *s. n.* (1); *11794* (4).
Brass, L. J. *14263, 14330* (1).
Bray, W. L. *416* (5); *s. n.* (6).
Brookes, J. *s. n.* (5).
Burnham, T. M. *291* (1).
Carlson, J. I. *s. n.* (4a).
Carter, A. *1429* (3).
Chase, V. H. *7644* (6).
Clifton, R. L. *3200* (5).
Clokey, I. W. *5952, 7367, 7369, 8177* (1).
Clokey, I. W. & R. G. Anderson. *7368, 8176* (1).
Clover, E. U. *1689* (6).
Clute, W. N. *24, 24a* (3).
Cockerell, T. D. A. *s. n.* (4).
Collins, D. W. *11* (4).
Collom, R. E. *65, 479* (1).
Cooper, J. W. *s. n.* (1).
Cory, V. L. *17611, 2695* (4); *4666, 5322, 13478, 15195, 37520* (5); *2688, 17685* (6).
Cory, V. L. & C. R. Ball. *1709* (5).
Cottam, W. P. *6589* (3).
Coues, E. & E. Palmer. *254* (1).
Coville, F. V. & F. Funston. *292* (1).
Cowen, J. H. *s. n., 276* (2).
Crandall, C. S. *2995* (2).
Creighton, H. B. *s. n.* (1).
Cutak, L. *1, 2* (6).
Cutler, H. C. *3135* (3).
Darrow, R. *s. n.* (1); *s. n.* (4).
Degener, O. *4907* (1); *4900* (3).
Degener, O. & K. K. Park. *4411* (3).
Demaree, D. *8031* (1); *7572, 7668, 7773* (5).
Dewey, L. H. *s. n.* (4); *s. n.* (6).
Dieffenderfer, F. R. *s. n.* (4).
Drushel, J. A. *10499* (4); *6280, 9687* (6).
Earle, F. S. *643* (4).
Earle, F. S. & E. S. Earle. *s. n., 374* (4); *s. n., 446* (6).
Earle, F. S. & S. M. Tracy. *42* (4).
Eastwood, A. *3692, 5816* (3).
Eastwood, A. & J. T. Howell. *6604* (3).
Edwards, M. T. *390* (6).
Eggert, H. *s. n.* (5); *s. n.* (6).
Eggleston, W. W. *10890* (1); *17187* (3); *10650, 16323, 16538, 17285, 20399* (4); *10945* (4b).
Evans, W. *s. n.* (4); *s. n.* (5).
Fendler, A. *461* (4).
Ferris, R. S. *8553* (1); *10213* (3).
Ferris, R. S. & C. D. Duncan. *2228* (1);

Nelson, A. *6319*, *6441*, *11671* (4); *6154*, *6716* (6).
Nelson, A. & R. A. Nelson. *1519*, *1535* (1); *2179* (4).
Orcutt, C. R. *6028* (5); *6318* (6).
Osterhout, G. E. *2127* (2).
Palmer, E. *140*, *246*, *538* (1); *246½* (3); *164* (4a); *35*, *380*, *678*, *679* (6).
Palmer, E. J. *32083*, *34216* (4); *11088*, *12472*, *12520*, *13050*, *14049*, *33542*, *34573*, *41863* (5); *11055*, *11267*, *30590A* (6).
Parish, W. F. *111* (1).
Parish, S. B. *10264*, *10285* (1).
Parry, C. C. *s. n.* (3).
Payson, E. *658* (2).
Peebles, R. H. *9539*, *13332* (3).
Peebles, R. H., G. H. Harrison & T. H. Kearney. *s. n.*, *1279* (1).
Pilsbry, H. A. *s. n.* (3); *s. n.* (4); *s. n.* (4b); *s. n.* (5).
Pittier, H. *507* (6).
Plank, E. N. *s. n.* (4).
Pringle, C. G. *s. n.*, *9845*, *13755* (1); *9954* (4); *71*, *71½* (4a); *216*, *9040* (6).
Purpus, C. A. *6125* (1); *183* (2); *s. n.* (3).
Reed, E. L. *3094*, *3408*, *3799* (5); *1811* (6).
Reed, E. L. & D. Demaree. *7636* (5).
Rehn, J. A. G. & H. L. Viereck. *s. n.* (4a).
Reverchon, J. *s. n.*, *505* in part, *3328*, *3328A* (5); *s. n.*, *505* in part (6).
Rollins, R. C. *1578*, *1970*, *2141*, *2155* (2).
Rollins, R. C. & T. S. Chambers. *2440* (3); *2418* (4); *2757* (6).
Rose, J. N. *1193* (4).
Rose, L. S. *40083* (1).
Rosynski, H. W. von. *305*, *328* (6).
Rothrock, J. T. *82*, *463* (4).
Rusby, H. H. *657*, *4734* (3); *175½* (4).
Ruth, A. *1283* (5).
Rydberg, P. A. & R. Imler. *716*, *796a*, *1120* (5).
Safford, W. E. *1266a*, *1296* (6).
Saunders, D. *405* (2).
Schott, A. *III 91* (1); *s. n.* (6).
Schulz, —. *38-39* (5); *3001* (6).
Schrenk, H. von. *37*, *42* (6).
Seler, E. *552* (6).
Shepard, M. *s. n.* (5).
Sherff, E. E. *s. n.* (1).
Shreve, F. *9356*, *9428* (6).
Shreve, F. & E. R. Tinkham. *9742* (6).
Siler, A. S. *s. n.* (3).
Smith, B. H. *s. n.* (4).
Smith, J. G. *25* (4).
Smyth, B. B. *140* (5).
Sperry, O. E. *250* (4); *1709* (4a); *T346*, *743* (6).
Standley, P. C. *s. n.*, *6445*, *40359* (4).
Stanford, L. R., K. L. Retherford & R. D. Northcraft. *31*, *159*, *257*, *550* (6).
Stearns, E. *s. n.*, *384* (4).
Stevens, G. W. *258½*, *593*, *715*, *973*, *1052*, *1637* (5).
Stewart, R. M. *s. n.*, *544*, *801*, *884*, *1273*, *1485*, *1572*, *2161* (4).
Stokes, S. G. *s. n.* (2).
Stone, F. M. *60* (1); *276* (3).
Stone, W. *184* (4).
Swift, —. *s. n.* (5).
Tharp, B. C. *s. n.* (1); *s. n.*, *286* (3); *s. n.*, *3886*, *7311*, *7315* (6).
Thompson, A. P. *s. n.* (3).
Thornber, J. J. *402* (1).
Thurber, G. *76* (4).
Toumey, J. W. *s. n.*, *639a*, *639b*, *639c* (1); *638* (3).
Townsend, C. H. T. & C. M. Barber. *364* (4).
Tracy, S. M. *8164* (4); *7875* (5).
Tracy, S. M. & F. S. Earle. *42* (4a); *208* (6).
Train, P. *1664*, *1804* (1).
Vasey, G. R. *s. n.* (1); *s. n.* (3); *s. n.* (4a); *s. n.* (4b); *s. n.* (5).
Viereck, H. L. *s. n.* (4a).
Vorhies, C. T. *56* (3).
Ward, L. F. *s. n.* (3).
Warnock, B. H. *726*, *1232* (4).
Warren, F. A. *1416* (2).
Waterfall, V. T. *3846*, *3888*, *3928*, *3940*, *3994*, *4017*, *4149*, *5008*, *5181* (4); *s. n.*, *4383*, *5511* (5); *4437*, *4681*, *4837*, *5125* (6).
White, M. *141*, *164* (5).
White, S. S. *2117* (6).
Whitehouse, E. *7314* (4).
Whiting, A. F. *756/892* (3).
Wiegand, K. M. & M. C. Wiegand. *2597* (6).
Wiegand, M. C. & G. B. Upton. *4474* (1); *4475* (3).
Wiggins, I. L. *6231*, *7737* (1).
Wilkens, H. *1790* (4); *1738* (4a).
Williams. *s. n.* (4).
Wilkinson, E. H. *s. n.* (4a).
Wislizenus, A. *36*, *82* (4); *303* (6).
Wolf, C. B. *2623* (4).

Woodhouse, —. *s. n.* (4).
Wooton, E. O. *s. n.* (1); *s. n.*, *6* (4); *s. n.* (6).
Wooton, E. O. & P. C. Standley. *s. n.*, *3320*, *3615* (4).
Wright, C. *1259* (5); *380* (6).
Wynd, F. L. *723* (4).
Wynd, F. L. & C. H. Mueller. *432* (4); *59* (6).
Young, M. S. *s. n.* (4); *s. n.* (5); *s. n.* (6).
Zuck, M. *s. n.* (1).

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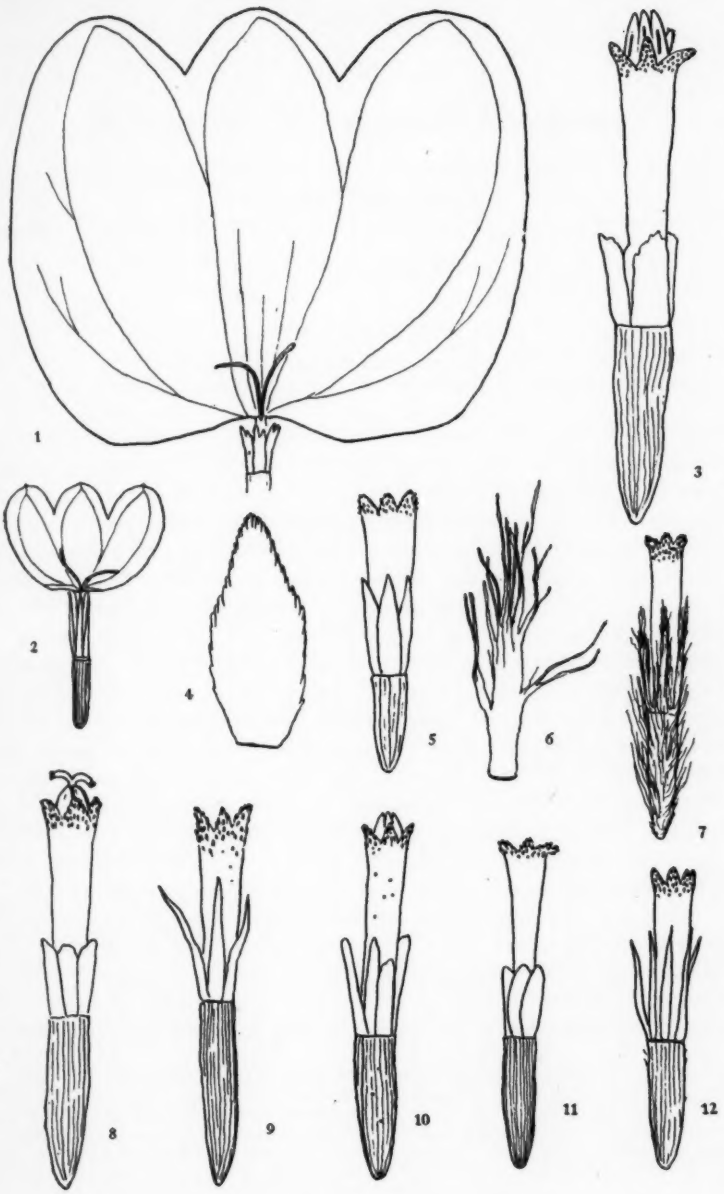
Valid names are printed in Roman type, synonyms in *italics*, and new combinations in **bold face type.**

Explanation of Plate

PLATE 14

Fig. 1. Ray-flower of *P. Cooperi*, x 5.
Fig. 2. Ray-flower of *P. villosa*, x 5.
Fig. 3. Disk-flower of *P. Cooperi*, x 7.
Fig. 4. Pappus scale of *P. tagetina*, x 18.
Fig. 5. Disk-flower of *P. tagetina*, x 7.
Fig. 6. Pappus scale of *P. gnaphalodes*, x 18.
Fig. 7. Disk-flower of *P. gnaphalodes*, x 7.
Fig. 8. Disk-flower of *P. Bakeri*, x 7.
Fig. 9. Disk-flower of *P. sparsiflora*, x 7.
Fig. 10. Disk-flower of *P. tagetina*, x 7.
Fig. 11. Disk-flower of *P. tagetina* var. *grandiflora*, x 7.
Fig. 12. Disk-flower of *P. villosa*, x 7.



HEISER—MONOGRAPH OF PSILOSTROPHE